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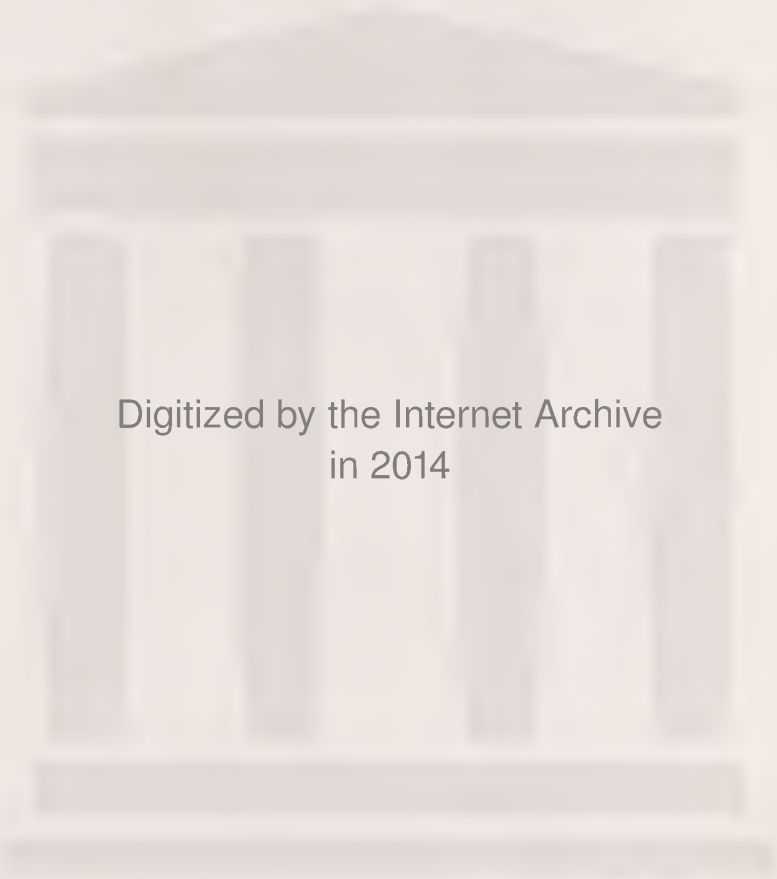

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THE WILLIAMSBURG BRIDGE

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AN ACCOUNT OF THE CEREMONIES ATTENDING THE FORMAL OPENING OF THE STRUCTURE, DECEMBER THE NINETEENTH, MDCCCCIII

TOGETHER WITH AN ILLUSTRATED HISTORICAL AND DESCRIPTIVE SKETCH OF THE ENTERPRISE

By EDWARD HUNGERFORD

AND CERTAIN STATISTICAL TABLES

PUBLISHED BY THE CELEBRATION COMMITTEE
OF THE BOARD OF ALDERMEN
OF THE CITY OF NEW YORK

M D C C C C I I I

THE EAGLE PRESS : : : BROOKLYN-NEW YORK

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City of New York

SETH LOW, : : : : : : : : : : Mayor.
GUSTAV LINDENTHAL, Commissioner of Bridges.
LEFFERT L. BUCK, : : : : Chief Engineer.

Aldermanic Committee

PETER HOLLER, Chairman.
JAMES H. McINNES
JACOB A. CANTOR
J. EDWARD SWANSTROM
FREDERICK BRENNER
JAMES J. DEVLIN
LEOPOLD W. HARBURGER
PATRICK S. KEELY
HERBERT PARSONS
MAX J. PORGES
TIMOTHY P. SULLIVAN
WILLIAM WENTZ

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SETH LOW, MAYOR OF NEW YORK

Formal Opening of the Bridge

THE Williamsburg bridge, connecting the boroughs of Manhattan and Brooklyn in the city of New York, was opened with appropriate ceremonies, Saturday, December 19, 1903. The affair was in every sense civic. Yet the ceremonies of dedication, as well as the jollifications that surrounded them, were in accord with the dignity of the occasion as well befitted the crowning of the largest suspension bridge ever constructed, the bridge that is designed to carry more traffic than any river span ever before built.

The day dawned cold and clear. A thick and obstinate haze hung closely over the city and the rivers that serve it, but the sun, as it mounted on high, slowly burned its way through the mist and a little after noon the veil lifted, disclosing the majestic lines of the bridge to the ferryboats' passengers and to those persons who had already grouped themselves at points of vantage along the shore. They perceived that the big Williamsburg structure had been transformed by the art of the decorator. Its immense proportions might have appalled the draper of flags and buntings, but he had gone

at his task bravely and the result had been obvious in the enhancing beauty which rosettes and semi-rosettes of Old Glory, long strings of bunting and banners and lines of American flags lent to the structure.

Special details of police were sent to the bridge and its approaches in the morning until a force of 1,400 patrolmen with their force of officers formed an adequate protection against the possibilities of accident or panic.

Mayor Low left the City Hall at about 1 o'clock for the scene of the ceremony. He was accompanied by Borough President Jacob A. Cantor, of Manhattan, Alderman James H. McInnes, vice-president of the board, James B. Reynolds, Mayor Low's secretary, Captain Perry, of the Brooklyn Navy Yard, representing Rear Admiral Rodgers, who was unable to be present; Health Commissioner Lederle, Lieutenant Commander Barry of the Navy, Police Commissioner F. V. Greene, Corporation Counsel G. L. Rives, President C. V. Fornes of the Board of Aldermen, Park Commissioner John E. Eustis, Correction Commissioner Thomas W. Hynes, City Chamberlain E. R. L. Gould, Tenement House Commissioner Robert W. De Forest, General J. G. Wilson, president of the New York Historical Society, John Bigelow, Water Commissioner Robert G. Monroe, Dock Commissioner McDougall Hawkes,

Borough President George Cromwell of Richmond, Aqueduct Commissioner Ten Eyck, Aldermen Sullivan, Harburger, Parsons and Porges of the committee in charge of the celebration; F. B. Thurber, Lewis Nixon, Smith E. Lane and James W. Boyle, former East river bridge commissioners; the Rev. Father Lavelle, H. A. Rogers, City Clerk P. J. Scully, Alderman Devlin, John P. Windolph, Elections Commissioners John R. Voorhis and R. C. Fuller, Tax Commissioners Rufus L. Scott, Samuel Strasbourger and George J. Gillespie; Theodore M. Banta of the Civil Service Commission, Park Commissioner Young, Tax Assessors Benjamin E. Hall, Henry B. Ketchum and Enoch Vreeland; William Montgomery, A. P. Proctor, F. W. Rhinelander, William J. Coombs, and William J. Moran, assistant secretary to Mayor Low.

The party, escorted by Troop "A," N. G. N. Y., drove through Broadway to Broome street, where the carriages in which it rode passed between a double file of the 71st Regiment, N. G. N. Y., drawn up for review. After that the Mayor and his party proceeded to the entrance of the Manhattan approach at Clinton and Delancey streets. There the delegation of city officials and citizens alighted preparatory to their walk across the new bridge.

In the meantime a similar party was setting forth

from the Borough Hall in Brooklyn. Troop "C," N. G. N. Y., acted as its escort, and in the carriages that contained the party were J. Edward Swanstrom, president of the Borough of Brooklyn; Joseph Cassidy, president of the Borough of Queens; Bridge Commissioner Gustav Lindenthal; Leffert L. Buck, chief engineer of the Department of Bridges; Andrew D. Baird, James A. Sperry, Henry Batterman, members of the first bridge commission; Julian D. Fairchild, John W. Weber, James D. Bell, members of the second bridge commission; John L. Shea, former bridge commissioner; David A. Boody, Charles A. Schieren, Frederick W. Wurster and Daniel D. Whitney, former mayors of Brooklyn; Archibald McLean, engineer in charge of the Brooklyn Bridge; William M. Calder, Superintendent of Buildings; William C. Redfield, Public Works Commissioner; John Thatcher, Superintendent of Sewers; Otto Kempner, Deputy Commissioner of Public Works; George W. Tillson, engineer in charge of the Bureau of Highways; F. J. Helmle, Superintendent of Public Buildings and Offices; J. A. Rooney, Supervisor of Complaints; A. J. Aubrey, secretary to Commissioner Redfield; R. W. May, Clerk of the Bureau of Street Openings; Richard H. Laimbeer, Jr., Deputy Fire Commissioner; Justin McCarthy, Jr., Secretary to the Borough President; Holton D. Robinson, Kingsley

L. Martin, Robert E. Hawley, Alexander Johnson, Edgar D. Knap, engineers of the Bridge Department; Arthur T. Reilly, auditor of the Bridge Department; Herbert F. Gunnison, Lieutenant-Colonel W. F. Spicer, of the United States Marine Corps; Norman S. Dike, Major Ebstein, Deputy Police Commissioner; Martin W. Littleton, President-elect of the Borough of Brooklyn; Commander H. Morrell, United States Navy; Medical Inspector G. H. Harman, United States Navy.

The Brooklyn members of the committee in charge of the ceremonies, who rode with the parade, were Aldermen Peter Holler, James H. McInnes, Patrick S. Keely, Frederick Brenner and William Wentz. They were accompanied by the other Brooklyn members of the Board of Aldermen.

The Brooklyn party, having received an early start, traversed the streets of that borough by a devious route until it reached the corner of Broadway and Rockaway avenue, where it fell in ahead of a citizens' parade that had been organized by citizens of the Long Island districts that hope to receive the greatest benefits from the new bridge.

The citizens' parade had started from Broadway and Rockaway avenue some time before, and under the charge of Grand Marshal William Cullen Bryant. It

THE SOUTH ROADWAY

was headed by the grand marshal and twenty-five mounted police and was composed of the following organized bodies:

First Division.

Officials of the Borough of Brooklyn, escorted by Troop "C," Cavalry, N. G. N. Y.
Company, U. S. Marine Corps.
Forty-seventh Regiment, Infantry, N. G. N. Y.
Ambulance, Second Brigade, N. G. N. Y.
G. K. Warren Post No. 286, G. A. R.
One Hundred and Thirty-ninth Volunteers, War Veterans Association.
People's Bridge Association, with Band.
Grand Street Board of Trade, with Band.
Mitchel's Band.
Broadway Board of Trade, with Float.
Twenty-eighth Ward Board of Trade.
Ridgewood Band.
Ridgewood Board of Trade Float.
Twenty-eighth Ward Taxpayers Association.
Ocean Hill Board of Trade.
Twenty-sixth Ward Board of Trade.
Citizens' Protective Association.
Fulton Street Board of Trade.
Eastern District Board of Trade.
Arion Singing Society. (Assigned to grand stand.)
United Singers of Brooklyn.
Schwaebischer Saengerbund.
F. F. William Battery, with Band.

Second Division.

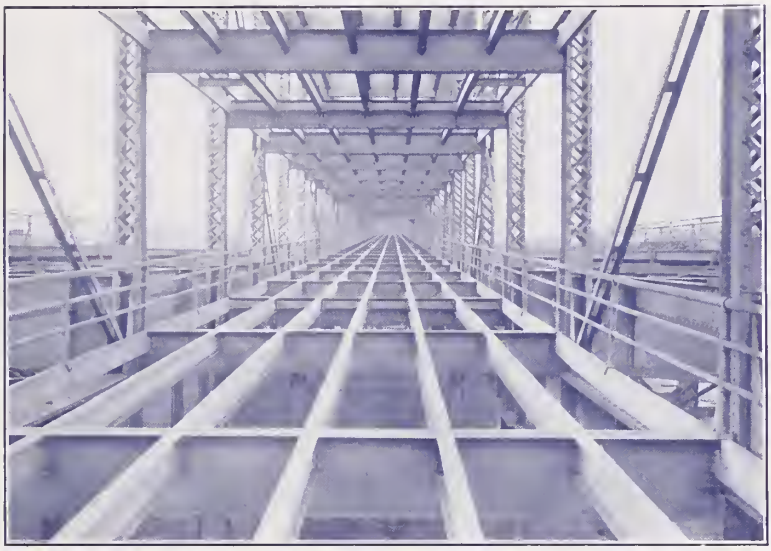
Letter Carriers' Division.
St. Francis' College Cadets.
St. Leonard's College Cadets.
St. John's College Cadets.

St. John's Home Cadets.
Educational Float.
St. John's Orphan Asylum Band.
Trinity Baptist Church Brigade.
Greene Avenue Presbyterian Church Brigade.
St. Thomas' Episcopal Church Brigade, with Drum Corps.
Holy Cross Episcopal Church Guards.
South Bushwick Reformed Church Brigade, with Drum Corps.
United Congregational Church Brigade.
St. Peter's Lutheran Church Brigade, with Drum Corps.
Irving Square Presbyterian Church, Battery A, Heavy Artillery, with Drum Corps.
Brooklyn Cadet Troop.
Industrial Float.

THIRD DIVISION.

Farmers Club, with Band and one Farm Wagon.
Unity Republican Club.
Turn Verein.
Bushwick Republican Club.
Jefferson Democratic Club, with Band.
Twentieth Assembly District Citizens' Union, with Drum and Fife Corps.
Twenty-first Assembly District Democratic Association.
Charles J. Haubert Battery.
Gravesend Exempt Volunteer Firemen's Association.
Young Men's Republican Club, Seventeenth Ward.
B. T. Union No. 70.
Knockers Club, with Tally-ho and Band.
Law and Order League.
Court Kings County, I. O. O. F.
Fifteenth Assembly District Republican Club.
Twentieth Assembly District Democratic Club.
Twenty-first Assembly District Republican Club.
Business Men's Association of Flushing.
Penn-Glen Wheelmen.
Automobile Division.
Mounted Police.

The parade proceeded straight down Broadway to the new bridge plaza, where it passed the grand stand and soon after swung into Bedford avenue. It continued up that thoroughfare, past the Hanover Club at Rodney street, where it was reviewed by the grand marshal before being disbanded. Its course had been



THE PROMENADE WITHIN THE END SPAN

between two heavy lines of applauding citizens and it formed an appropriate opening for the afternoon's ceremony.

As it passed through its final stages of progress the delegation of Brooklyn borough officers, aldermen and citizens, led by Borough President Swanstrom and Aldermen Holler, Keely and Brenner, walked out the

Brooklyn side of the bridge. At a point only a few feet east of the mathematical centre of the bridge the party halted in the south roadway and awaited the arrival of the Mayor.

The Mayor and the Brooklyn Borough President shook hands at the centre of the bridge at just 2.30 o'clock that afternoon. Then the entire party turned toward Brooklyn and the bridge was formally opened for traffic. This simple ceremony had been witnessed by comparatively few. Yet the booming of cannon from the bridge approaches in both boroughs was that instant followed by a din of steam whistles, in which harbor-craft, both large and small, joined, and whose echoes were taken up by factory whistles and church-bells. In this way the actual moment of meeting on the bridge was carried far and near and was made a moment of interest and note.

The party of gentlemen, unescorted and bearing no sign of its rank save the silken ensign of the Mayor, which was carried by a detailed police officer, proceeded to the plaza in Williamsburg, where a great concourse of persons surrounded the temporary grand stand that had been erected there.

The exercises that followed were deeply impressive. The stand was filled with city and borough officers and invited guests. Alderman Peter Holler, Chairman of

the Committee on Exercises, briefly introduced the ceremonies. There was profound silence as the Rev. James H. Darlington, Ph.D., rector of Christ Church, Williamsburg, arose and offered the invocation, which gave way to hearty applause as Gustav Lindenthal, the Commissioner of Bridges, started his speech of presentation. Mayor Low's acceptance of the bridge, given in response to the presentation address, was felicitous and was greeted with a most cordial reception. Borough President J. Edward Swanstrom, of Brooklyn, had recently been somewhat indisposed. His address was short and pithy, and was well received, together with that of Borough President Jacob A. Cantor, of Manhattan, which followed. Senator Patrick H. McCarren, a resident of Williamsburg for many years, found his appearance a signal for an ovation. At the conclusion of his remarks, the Rev. Father Lavelle offered a profoundly beautiful and impressive benediction, which had been written for the occasion by Vicar-General Mooney. With the singing of a single stanza of "The Star-Spangled Banner" by the assembled concourse of citizens the speech-making ended.

Mayor Low, together with the other members of the party who had attended the simple ceremony on the middle of the bridge, then repaired to the hospitable

home of the Hanover Club. There a luncheon was served to the party, which ended in a general reception and the exchange of felicitations upon the successful manner in which the ceremony of opening the bridge to the public had been accomplished.

The day ended with an elaborate display of fireworks from the bridge structure and many jollifications. Thousands of persons—just how many will never be known—witnessed the pyrotechnic display from points of vantage near and far. They gazed with rapt attention at the beautiful spectacle placed before them—the great bridge gleaming in fire from end to end.

C. V. FORNES
President of the Board of Aldermen

EDWARD M. GROUT
Comptroller

Alderman Holler's Introduction

WE are now ready to begin the ceremony of opening to the public the second and the greater of the two steel bonds which join our boroughs into one. Though separated by the river, we have always been one city in sympathy, one in mind, one in heart. These bridges are only visible expressions of a unity which has always existed.

I now have the honor of introducing to you a clergyman who, as rector of Christ Church, Williamsburg, is known throughout all the boroughs, both as a preacher and citizen, the Rev. James Henry Darlington, Ph.D.

THE PROMENADE NEAR THE BROOKLYN PLAZA

JACOB A. CANTOR

PETER HOLLER

JAMES H. MCINNES

J. EDWARD SWANSTROM

HERBERT PARSONS

PATRICK S. KEELY

WILLIAM WENTZ

FREDERICK BRENNER

LEOPOLD W. HARBURGER

JAMES J. DEVLIN

MAX J. PORGES

TIMOTHY P. SULLIVAN

THE ALDERMANIC COMMITTEE

Rev. Dr. Darlington's Invocation

HEAVENLY FATHER, we thank Thee to-day for the fulfilment of many hopes and the completion of a great endeavor. We thank Thee for another tie joining hitherto separated sections of our municipality. May we feel, like St. Paul, that we are citizens "of no mean city." May we glory in her triumphs and be proud of her wealth and influence, even while we sorrow for her poor, and mourn her shortcomings and sins. May the multitudes of every race and tongue, intent only on food, raiment and daily necessities who pass and repass over this bridge—greater than any other yet attempted by human hands—be led by its very greatness to think first of its creation in the minute mind of man, and then of the Creator of the universe who made that brain and all other things. May we thus through its very symmetry, size and perfection, be led to honor Him who is the great Designer and Architect of creation.

Let the people praise Thee, O God; yea, let all the people praise Thee.

Then shall the earth bring forth her increase; and God, even our God, shall give us His blessing.

God shall bless us; and all ends of the world shall fear Him.

Praise God, from whom all blessings flow,
Praise Him, all creatures here below,
Praise Him above, ye heavenly host,
Praise Father, Son and Holy Ghost.

CHARLES A. SCHIEREN,

MAYOR OF BROOKLYN WHEN THE FIRST BRIDGE COMMISSION WAS APPOINTED.

Commissioner Lindenthal's Address

MR. MAYOR—It is my agreeable duty to-day to officially announce to you, as the head of the city's government and administration, that after seven years of continuous and difficult work the second bridge across the East river is completed, so that street traffic can pass over it from now on without interruption.

More than twenty years ago, when the first bridge over the East river was opened, with great and imposing ceremonies, you were one of the distinguished participants, as the then Mayor of Brooklyn. Permit me to congratulate you on your presence as the chief magistrate of our great consolidated city at the opening of this second bridge. It is probable that neither yourself nor any one of the participants of that memorable occasion expected to see another bridge built over the East river within a generation.

So great were the difficulties in the construction of that first bridge, so many were the new problems to be solved, that fourteen years were required for its completion. In the meantime, the progress in the art of bridge-building has been so rapid that for the second

bridge only one-half the time of the first bridge was required. It is within the bounds of reasonable expectation that the time of completion of the third and fourth East river bridges, already in process of construction, and of those which have not been planned yet, but which may later be needed and built, will be little more than half the time consumed in the construction of the Williamsburg bridge.

This structure is to-day the heaviest suspension bridge in existence, and the largest bridge on this continent. It is twice as strong as the Brooklyn bridge. The imposing and stately stone towers of the Brooklyn bridge give that structure the appearance of great strength, but in the steel towers of the new bridge, and in all its other elements, a greater power of resistance is hidden.

The bridge has a width one-half greater than that of the Brooklyn bridge, and will, therefore, be better able than that avenue to meet the never ceasing and ever increasing traffic between the two parts of New York City separated by the East river.

So far as engineering science can foretell with confidence, this colossal structure, if protected against corrosion, its only deadly enemy, will stand hundreds of years in unimpaired strength. Small as the traffic over the bridge may be at first, it will no doubt grow to

even greater volume than that which now rolls over the Brooklyn bridge at the rate of 120,000,000 passengers per year, a traffic volume which has never been dreamed of by the builders of that bridge in their most extravagant enthusiasm.

The first bridge was built to connect two cities—New York and Brooklyn. This second structure over the East river is the first one built by the present consolidated great city, New York, which is destined to become the largest city in the history of mankind. It will have a distinction all its own, aside from its size. Our city will be pre-eminently the city of great bridges, representing emphatically for centuries to come the civilization of our age, the age of iron and steel. A time must come, not many generations distant, perhaps not more distant than the crusades in the past, when the building of such colossal structures will cease because the principal material of which they are molded, that is, iron and steel, will not be longer obtainable in sufficient quantity and cheapness. When the iron age has gone, the great steel bridges of New York will be looked upon as even greater monuments than they are now.

In informing you, Mr. Mayor, officially and ceremonially, that the Williamsburg bridge is ready for the opening of traffic, I feel that it is also my most

pleasant duty to invite, on behalf of the city, your appreciation of and thanks for the faithful work of the members constituting the two commissions, who inaugurated, organized and formulated the plans. Thanks are also due to all the members of the engineering staff, who have designed and executed the work with untiring devotion to duty, as well as to all the contractors, whose skill and energy contributed toward the accomplishment of this great work.

COL. WILLIAM L. STRONG

Mayor Low's Address

TWENTY years ago, last May, the Brooklyn bridge, the first to span the East river, was thrown open to the public with imposing ceremonies. In its marvellous combination of graceful beauty and massive strength, it at once took its place among the great structures of all time. It remains what it was then, one of the wonderful creations of the brain and hand of man. To-day, we are engaged in opening for public use the second bridge across the East river; thus happily illustrating the old adage, that "what man has done, man may do." This second bridge indeed is larger, in every way, than its fellow. It is half as wide again; it is longer, and more commodious. There is a likeness between the two bridges which is inspiring, but there are also differences, both in point of construction and in the circumstances attending their completion, which are full of interest and suggestion.

In type, the two bridges are alike, but it is indicative of the marvellous growth of the manufacture and use of steel in this country since 1883 that the masonry towers of the first bridge have given place in this one

to towers of steel. This reveals in a striking fashion how the use of steel is replacing stone as well as iron and wood for many kinds of construction, and throws interesting light for the layman on the magnitude of the demand for the products of the steel furnace.

The distinguished engineer, Mr. Leffert L. Buck, to whose genius the community is indebted for this imposing structure, has placed the country under obligations to him in more ways than one. In August, 1861, he enlisted as a private in the 60th New York Volunteers and served continuously until he was mustered out, as Captain, in August, 1865. At the battle of Lookout Mountain, the color sergeant of his regiment was wounded, and Sergeant Buck, as he then was, grasped the colors and carried them to the end of the day. Before enlisting, he had worked four-and-one-half years in a machine shop; and, upon being mustered out, he entered the Rensselaer Polytechnic Institute of Troy as a second-year student, graduating in the class of 1868. It is little wonder that our armies could bridge rivers, and operate railroads, and surmount unimaginable obstacles, when private soldiers were in so many cases of the type of Mr. Buck. Neither is it any wonder that our country has forged steadily ahead since the war to the first place in the industrial world, when men who gave four years of

their youth to the exciting demands of war could turn so easily to school for further preparation for the arts of peace. Mr. Buck has indeed risen to an eminence in his great profession, to which few attain; but in the steps of his progress, he has been typical of the great body of his countrymen. The capacity to adapt himself to new and strange conditions has always been characteristic of the American, and I know not whether to admire more the spirit and the ability to go from the machine shop to the army in order to make one of the irresistible host of freedom, or the spirit and the ability to go from the army to the professional school in order to become one of the servants of mankind by the construction of such a superb bridge as this. In voicing this tribute to the engineer, I like to recall at the same time our obligation to the good citizen who hazarded his life for the preservation of the Union.

No such achievement as this bridge is ever the work of a single man. To all who have taken part in it, to the successive Mayors, Boards of Trustees, Bridge Commissioners, Engineers, Contractors and others who have had part in it, I offer the City's thanks; and especially to those of every handicraft who have done the actual work in the shop and on the spot, below water and above, upon the bridge itself. No less than 31 men have

lost their lives in the process of its construction, as if by such sacrifice to consecrate the bridge not only in the esteem but also to the service of their fellow-men.

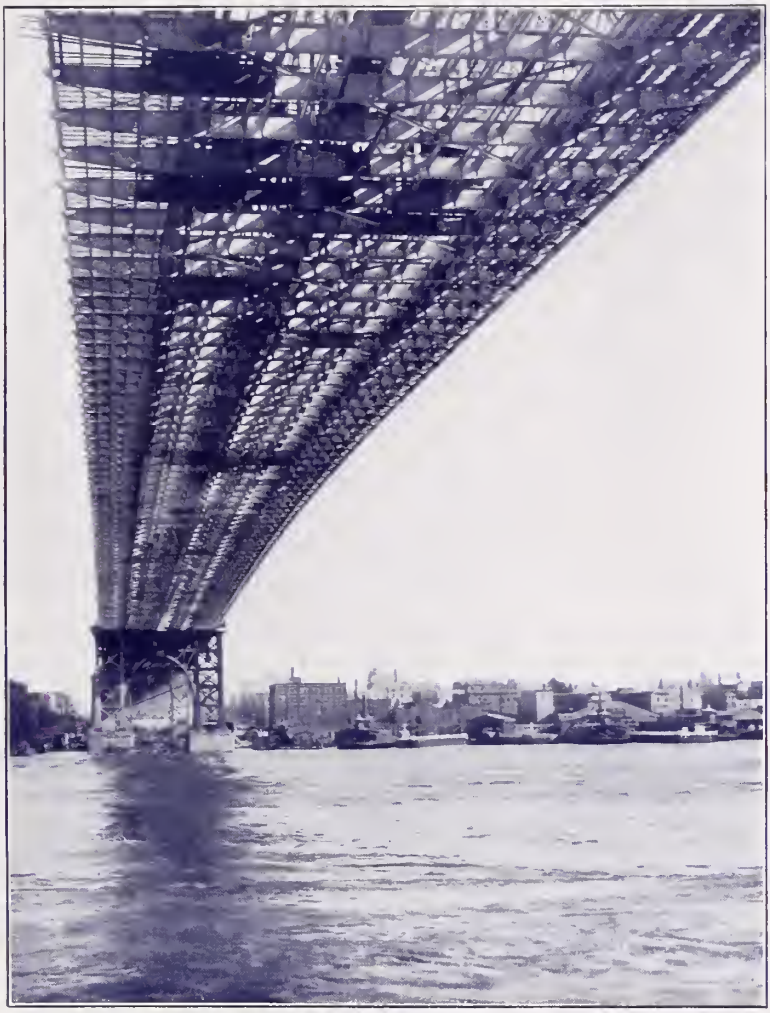
It sometimes seems as if no work of any kind of enduring value was ever completed except at the cost of human life. It is as though it were only when men build their lives into their work that the work itself becomes worthy to endure.

The changes wrought during the twenty years since the Brooklyn bridge was opened, in the conception of the function of an East river bridge, and in the political relationships of the communities which such a bridge is to serve, are even more interesting than the changes in mechanical construction. When the Brooklyn bridge was opened, two cities, which before had been divided by a river, were for the first time connected by a bridge. This physical tie, slight as it was, proved to be prophetic of their manifest destiny. To-day, the Williamsburg bridge, although it was begun when the two communities were still politically distinct, unites, not two cities, but two boroughs of the same city. The East river has become a highway running through the city, instead of a stream dividing two cities from each other. This bridge will be followed, within the next five years, by two others; and then it will be even more apparent than it is now how

truly one is this vast community in all its parts. The Brooklyn bridge was built originally with two railroad tracks, upon which it was expected that passengers would be carried to and fro upon shuttle trains. The evident possibility and desirability of through traffic across the bridge, when it was once opened to travel, have warped it from its intended use, and have subjected it to demands that were not contemplated when it was designed. Trolley tracks have been laid upon the roadways, thus reducing their availability for the purposes for which they were constructed and throwing a strain upon the structure which was not contemplated. Neither the terminal facilities nor the structural arrangement of the first bridge lend themselves well to the use that has been made of it. Despite all discomfort, however, this use has prevailed, and in so doing it has changed our conception of the true function of such a bridge. Twenty years ago, when the first bridge was built, it was thought of as a structure for uniting independent communities, the use of which, in turn, was to be independent of the system of travel in both. Public convenience has broken down that idea, and an East river bridge must now be thought of simply as a highway over the water, closely related to the highways on both sides of the river. The problem of providing railroad transit across such a

bridge has thus been made infinitely more difficult, because the authorities are obliged to consider not only the use of the bridge itself but also its use in connection with the railroad systems on either side; and because it is necessary to secure the co-operation of one or both of these systems in order to realize the best use of the bridge as a railroad thoroughfare. The problem is still further complicated, because the trolley system at one end of the bridge is an overhead system and at the other end an underground system. The strong disposition, in Manhattan, to develop subways, as distinguished from elevated roads, is still another embarrassment. Such a problem as this would be difficult enough to solve if the city were in full control of all the elements of it; but the city can only move successfully when it has secured the co-operation of one or the other, or of all, the private enterprises that control the transit facilities of the two boroughs. Every aspect of this problem has been the subject of continuous study and conference during the last two years, and there is reason to hope that, in the near future, an acceptable solution of it will be found. The actual opening of the bridge to public use is likely to do more than anything else to hasten the day of mutual agreement.

Allied to this problem, and yet different from it, is



BENEATH THE SPAN

the necessity of providing adequate street approaches to the bridge, a necessity springing from the conception of it as a highway. When this bridge was designed, seven years ago, a plaza was provided at each end, as if that were all that were necessary. Doubtless some realized, even then, that the bridge would necessitate a costly rearrangement of its street approaches; but nothing further was then done. In Manhattan, a plaza 200 feet square has now been provided for, and Delancey street has been ordered to be widened, from the bridge to the Bowery, to a width of 150 feet. In the spring, the actual construction of this plaza and thoroughfare will be begun. A new street, 80 feet in width, continuing Delancey street to Elm street, has also been laid down upon the map; but the work of construction here has not been authorized by the Local Board. On the Brooklyn side, a large plaza has been created, and alternative plans have been submitted for the cutting through of Grand street to this plaza, and for the widening of Roebling street to the north. The opening of Grand street through to the plaza seems to be clearly wise.

The widening of Delancey street from the bridge to the Bowery will displace 5,000 people, compelling them to find new homes; and the creation of the Brooklyn plaza has displaced about 3,000 more. It is estimated

that more than 10,000 people have already been displaced in Manhattan by the construction of this bridge. Thus almost 20,000 people have been compelled to seek new homes by reason of this enterprise. This seems to be the occasion to make acknowledgment to the many thousands of our fellow-citizens who have thus submitted to inconvenience in the public interest.

The necessity for this street development comes, as I have said, from the new conception of an East river bridge as part of the thoroughfare system of the city, and that conception itself has only been really brought home to the people by the actual use of the Brooklyn bridge. It is an interesting commentary on this demand that, with the exception of the abortive widening of Liberty street in Brooklyn, nothing has yet been done to improve conditions at either end of this great structure. I think the time will come when the city will cease to make a railroad yard out of the land lying between Sands street and the Borough Hall of Brooklyn. By providing for through communication between the various bridges, thus doing away with the necessity for a railroad yard at this point, and by deflecting the tracks in Brooklyn to the north, an opportunity can be had, at comparatively little expense, for providing a wide thoroughfare from the Brooklyn end of the bridge to the Borough Hall. This would give to Brooklyn what

it greatly needs, and deserves, an entrance that can be made both attractive and interesting.

This discussion shows how easily communities that are really one can become one in fact, however long they may have been divided. It illustrates, also, how great is our indebtedness, as a city, to such men as Andrew H. Green and J. S. T. Stranahan, not to mention others, both living and dead, who through good report and evil report, preached the gospel of consolidation until it became an accomplished fact. When one tries to imagine the consequences to the great city, in the distribution of its population and in other ways, that will follow the completion of this bridge and of the two other bridges which have been already begun, and of the tunnels that are projected, the imagination is staggered. At the present time there are only four tracks between Manhattan and Brooklyn, two of which are trolley tracks operated at every disadvantage on roadways for vehicles. Inside of five years, 28 additional pairs of tracks, by bridge and tunnel, are likely to be in operation, every one of which will be free from the interruption of other travel. In the decade between 1890 and 1900, the population of Manhattan and The Bronx grew, approximately, to the extent of 450,000. In the same decade, the population of what are now the Boroughs of Brooklyn and Queens grew, approximately, to the

extent of 400,000. If this has been the comparative rate of growth during the *regime* of the single bridge and the ferries, what will be the proportionate rate of growth when there are four bridges and two tunnels crossing the East river, and when there are thirty-two pairs of railroad tracks as against four? This, of course, is not a complete statement of the problem, for the subway in Manhattan to the north will immensely increase the facilities for travel in that direction, and the additional lines of subway to The Bronx that are already under consideration will do still more to equalize the opportunity of access to the different boroughs. The establishment of a municipal ferry to Richmond will also facilitate the movement of population to that borough. One thing, however, may be confidently predicted. For many years, the population of New York will spread itself out over a wider and wider area, and the terrible congestion of population in parts of Manhattan island should at least be held in check and will probably be modified. Such a result, from every point of view, is devoutly to be wished. It has been made possible by consolidation, and it will remain the abiding vindication of that achievement.

Standing here, at such a time and on such an occasion, one strives in vain to picture to himself the future of the City of New York. Already, it is a city wonderful

in its resources, wonderful in its achievements, and still more wonderful in its possibilities. It contains within its borders 350 miles of waterfront—the waterfront of a principality. Its great rivers, which have separated it from itself and from the mainland, are being pierced by tunnels and spanned by bridges in every direction, so that the city in the near future, in all its parts, will command what it has never had before —unbroken communication with the continent, and this without suffering any impairment of its superb rivers or harbor. With this new access of opportunity and this new sense of power, there has come into our civic life a new sense of beauty and a new scale of grandeur. The city that is to be, 20 years hence, is likely to surpass the city that we know, in beauty and in impressiveness, as much as the city of the Williamsburg bridge surpasses the city of the Brooklyn bridge of twenty years ago.

Let us who are New Yorkers never lose faith in our city; let us never lose our pride in it; and never lose our love for it. Continually it is taking on new characteristics, both outwardly and inwardly. They who have to do with its affairs must always be alive to these things. Decade by decade, the standards of its municipal life advance, and decade by decade, by reason of the higher standards, things that were formerly accepted as a matter of course become impossible. He who is permitted,

either in public or in private life, to do anything for the welfare of such a city may well count himself a happy man; for it has been given to him to serve a city which is already one of the most powerful centres of influence in the world, and whose influence is destined to become more and more dominating as the years roll on.

Mr. Commissioner, I accept the Williamsburg bridge from your hands, on behalf of the City, with the more pleasure because I know how much you have done to hasten its completion, and I pronounce it to be open from this day forward to the public use.

FREDERICK W. WURSTER

ROBERT A. VAN WYCK

MEMBERS OF THE FIRST AND SECOND BRIDGE COMMISSIONS

President Swanstrom's Address

THE opening of the new bridge across the East river is an event so altogether unusual that it has occurred but once before since Columbus discovered America.

This occasion may therefore be truly regarded as one of supreme importance to the welfare and prosperity not only of this borough but of our greater city.

Since the old bridge was opened to public use, twenty years ago, we have seen Brooklyn grow from a community of 600,000 souls to a population of more than double that number.

The joining together of the two cities of New York and Brooklyn by a ligament of steel made it inevitable that they should eventually be consolidated under one name and one government.

It is an interesting and rather happy coincidence that Mr. Low, who, as Mayor of Brooklyn, was called upon to accept the old bridge when it was formally opened, twenty years ago, is present here to-day to perform a similar function as the chief magistrate of the greatest city in the world but one.

We who are Brooklynites may well congratulate

ourselves upon the completion of this new and magnificent avenue in the air. We have waited patiently for its completion these many years and now that our patience has been rewarded we gratefully welcome this splendid achievement, rejoicing in the knowledge that it will stand for generations to come as a monument to the energy, enterprise and public spirit of the people of this great metropolis.

GUSTAV LINDENTHAL

NELSON L. ROBINSON

President Cantor's Address

THE formal opening of this great piece of bridge construction, stately and magnificent, vividly reminds us not only of the exercises which attended the opening of the Brooklyn bridge, the lessons which were then taught and the opinions expressed, but recalls also the hopes, fears and anxieties so eloquently presented by the distinguished speakers on that occasion. That event occurred almost twenty years ago, and several of the speakers on that memorable occasion gave expression to the thought that New York and Brooklyn were closely drifting together and that the ultimate result would be the consolidation of the two cities into one municipality. In the eloquent oration of that distinguished and patriotic New Yorker, Abram S. Hewitt, he expressed some apprehension and anxiety in case such a result was accomplished. At that time there had been more or less agitation in favor of the project, but in speaking of the maladministration existing in New York, he said that in his judgment there would be an inability on the part of the greater community to satisfactorily solve these municipal problems, and he

feared, from his knowledge of municipal affairs, that greater evils would necessarily follow under a more extended form of government.

Notwithstanding these opinions, thus expressed by a man who has indelibly impressed his individuality upon our city, another equally distinguished New Yorker, Andrew H. Green (who recently passed to the Unknown), with a determination, zeal and energy unsurpassed, carried on the project until his hopes were realized and the greater city became an accomplished fact.

The apprehensions I refer to were shared by many of our people for the reason that municipal government throughout this country and elsewhere had proved to be weak, ineffective and fraught with many evils. Citizens of the various municipalities were engaged in the great struggle for better government, and were exhausting all their resources and energies in eradicating existing evils. Local self-government was on trial, and measures were being constantly devised for the substitution of a governmental framework that would check corrupt practices, concentrate responsibility, purify the ballot, make maladministration more difficult and arouse the activities of a sluggish citizenship. The world had been taught that smaller municipalities were more easily and better governed because a closer watch

could be kept on the officials entrusted with the governing power; but when it was generally known and admitted that even these smaller cities failed to show the beneficent local government which their requirements demanded, it is not to be wondered at that many broad-minded citizens, keenly anxious for wholesome government, should have dreaded even the possibility of the creation of a greater city, with its vast population, governed by an army of officeholders, with increased taxation, and with millions to be annually spent for public improvements.

But this greater city has weathered the storm and has to a very great extent justified the expectations of its founder and those closely allied to him, and as time has passed, the fears, anxieties and doubts of those who opposed the creation of it, have been gradually dispelled.

It might be interesting on this occasion to give a rapid sketch of the growth of the city from its early days, when, through the graciousness of Stuyvesant, freedom was given to its citizens and self-government was established. Old New York, then confined in territorial extent to Manhattan island, has grown slowly but surely from an insignificant community to one of exceptional power and influence. Its great interests have been carefully nurtured, its commerce largely increased

and its financial power steadily advanced until to-day it stands the queen of this great continent, with its wonderful influence radiating throughout the world.

What has brought about this remarkable growth of power and of influence? When we remember that the city at its birth had limited resources and sparse population, with but little trade and many rivalries, how was it possible for this small and struggling community—a mere speck on the map of the world—to literally overshadow older established communities, whose resources had been already developed, and whose power was felt and feared wherever trade and commerce penetrated? What magic wand touched our city and made possible this glorious reality? By what means did this miniature city develop into the greatest metropolis on this continent, and one surely destined to be the greatest city in the civilized world? It is true that nature has given us a harbor fully equal if not surpassing that of any other city in any country in the world; a gateway leading from the great ocean up to our very doors, and that undoubtedly has given us a great commercial advantage, as it provides direct access to foreign lands. It cannot be disputed that this picturesque harbor, thus designed by nature for the great carrying trade of nations, has been one of the chief causes leading up

to our development and prestige. It gave us a start in the world-wide battle for commercial supremacy. But then this great advantage which God has given to the city, would not have been utilized, as shown by other countries where similar advantages remain unimproved, had it not been for the sturdy character, strength of purpose, fixed determination and patriotic qualities of the earlier settlers, and those who by recent persecution and love of freedom had found homes on its shores.

While it is true that the governmental power of the early city extended over the whole of the island, still its population was narrowed down to a small section. It must be said to the credit of the people, however, that they carefully watched the administration of affairs so that many blessings flowed from it. It was a simple piece of municipal machinery, closely watched and economically administered, with every proposed improvement carefully scanned and debated before undertaking, both as to necessity and cost.

The rural settlement just north of the Harlem river, now the busy borough of The Bronx, did more or less trading with the people of Manhattan island, and in order to facilitate not only a rapid intercourse, one with the other, but to provide adequate transportation facilities for those coming from other places, a bridge over the Harlem

river was built. Of course, this structure, so modest in design, served the purpose of the railroads as well —those great channels of communication which have opened up this great country and by means of which thousands of thriving cities and villages have sprung into being, bringing development and prosperity from their touch, and causing the golden grain and other agricultural products to be sown and harvested and afterward distributed through the markets of the world.

It can be truthfully said, therefore, that bridge-building, to a very great extent, has been inspired by railroad necessities. And so this bridge, which to-day starts on its career of usefulness, will fail almost wholly of the purpose of its building if adequate railroad facilities are lacking.

I need not speak in detail of the development of the early city and of the territory it embraced. Its growth in population, in business, in finance is known to all, and its high and proud position in the busy markets of the world has been reached, not only through the character and integrity of its business men, but by the shrewdness and patriotism of its people. No merchants or bankers are more widely and favorably known as men of high purpose, with the ennobling qualities of sterling manhood, than those of this city. From them

THE BROOKLYN PLAZA

have emanated those high standards of commercial rectitude, which, disseminating through other business centres, are now recognized as the characteristics of the American commercial spirit of to-day.

Neither have our people been lacking in those traits of generosity, benevolence, human sympathy, and last, but not least, religious convictions no less important. Let me first speak of the religious spirit, which, from the founding of the city, has been most active in our midst. I do not refer to mere forms of worship, nor even to activity in church affairs. But I mean a radical belief in the divine power, which has helped not a little in influencing individual action and making the better and purer citizen.

And so from the early inception of this community down to the present day these principles and doctrines, inherent in our people, have had a most important bearing in preserving not only the honor of our city, but the character of our citizenship.

As to her charities, her great structures erected for the alleviation of distressed humanity in all forms will bear silent but ample testimony in this direction. If the army of men and women who, day by day, unselfishly guided by motives of humanity, are unostentatiously making life better, happier and more attractive to thousands who need this help—I say, could this but be

observed, it would teach a lesson eloquent and godlike, beyond the power of human pen or tongue to fitly describe. The humane impulses of our people are quickly touched by storm or disaster wherever occurring, and prompt has been the response to every appeal. No stricken community has ever made an appeal to this city which has not been promptly and most generously responded to.

I have endeavored briefly to note some of the predominating traits in the busy life of the old city, and have referred to its great influence, power and recognition throughout the world. It is not surprising, therefore, that the people of the surrounding territory, who have felt its influence and appreciated the beneficent results that would flow from a closer communion, were desirous of including themselves within its domain.

And it naturally followed that these smaller communities thus adjacent to it, becoming more and more closely identified with the business life of the city, and possessing the same qualities and principles, fondly looked forward to the time when they, too, should participate actively in the glory of the city by becoming New Yorkers.

The first people to actively evince this spirit were those of The Bronx, then a sparsely settled territory, and New Yorkers generously responded to its request

to become a part of the municipality. Since it became a part of New York its territory has been transformed, the bad physical conditions which formerly existed have been greatly changed, transportation facilities have been afforded, many public improvements, such as parks and other evidences of enlightened citizenship, provided, and it has become a borough teeming with life and business activity, furnishing comfortable homes and opportunities to the people living within its borders. It required the material help of old New York to provide these improvements, but she willingly extended it and she has been rewarded by having a happy and prosperous people added to her splendid citizenship. Bridges of size and beauty have since been built, increasing largely the strength and influence of the borough and making the interchange with the people of old Manhattan island comfortable and convenient.

The beneficent effects derived by The Bronx, and the similarity of traits of the people of Brooklyn and New York, paved the way for the consolidation of those two cities into one municipality. We in Manhattan had always recognized the sterling character of the people of Brooklyn, so closely approaching our own, that we naturally took kindly to the proposition thus advanced. Brooklyn had always been noted for its piety, its love of home comforts and its resistance to demoralizing

influences. Brooklynites as a rule have always possessed the natural desire to become New Yorkers, though this is not true of all of them. These two cities were practically one community, with similar impulses, and with closely allied business interests. And this similarity of conditions, combined with these high purposes, gave great impetus to the movement in behalf of consolidation.

I well remember the struggle which occurred at Albany in behalf of the greater city, as I had the pleasure of introducing in the Senate, as a Senator, through the courtesy of Mr. Green, the original resolution providing for the appointment of a commission to determine the feasibility of consolidation, and subsequently participated in all the legislation which led up to the creation of the greater city, as I also voted for the charter which created a government for it.

This period of time is so recent that it is not necessary to refer more than briefly to the battle which raged fiercely in and out of the legislative halls upon this subject. There were many in New York and some in Brooklyn who believed it was their duty to patriotically oppose the founding of the greater city, thinking that it meant increased taxation, the creation of useless and expensive offices; that it would require extravagant appropriations, and above all, that the organization of

a local government would necessarily be so vast, unwieldly and unmanageable as to be inefficient, and that it would result in developing evils of administration hitherto unknown, without, on the other hand, giving to these communities any beneficial results commensurate with the dangers which were liable to ensue.

While these well meaning people fought consolidation disinterestedly, yet beneath it all (and which made success certain), were strong, determined and patriotic people insisting that as the interests of these communities were identical and were practically one, a single government should control the affairs of both.

On the other hand, the politicians of both political parties were figuring on what the effect of consolidation would be upon the fortunes of the respective parties to which they were attached. But it finally ended in the creation of Greater New York, which included Richmond, with her natural commercial advantages, her splendid harbor and peaceful citizens, and Queens, with her great territorial domain lying between the East river and the ocean, and with her thriving villages, her manufacturing industries and her steadily growing population—all these were embraced within the territory of Greater New York.

It was a great experiment to include within this vast territory a population, not only engaged in

commercial pursuits, trade and manufacture, but embracing farmers and gardeners as well. With such a population, great in numbers, diversified in pursuits, accustomed to local village government, in many instances with suburban environments, made into an urban population governed by one administration, more or less removed from the immediate neighborhood, it is no wonder that Mr. Hewitt and others at that time looked with feverish anxiety and apprehension upon the consummation of such an event.

The new city, however, was formed and the first question naturally arose as to how these peoples, scattered throughout the boroughs, could be brought into closer touch and made to realize that, not only were they a part of the great municipality in governmental affairs, but that they were also a physical part of it as well.

The first step in the direction of bringing the boroughs together was in construction of bridges over the water highways separating these boroughs from old New York. And then in anticipation of these conditions a law was enacted which brought into being finally this great structure dedicated to-day. As I bore a leading part in the consolidation of this great municipality, so also I had the distinction in the State Senate of having advocated the creation of the commission to supervise

the building of this great triumph of bridge architecture.

It is not necessary to dwell at length upon the benefits that will be accomplished through this great work, or to call attention to the details of its construction, or even to speak of the genius of the engineer who designed it, or of the army of mechanics in the workshops who have produced its various sections, nor of the skill and ingenuity which enabled this great work to be put together. It is sufficient to say that its creation was designed by an American brain, that its various parts were made and welded together by American hands and that it is an erection by American workmen.

The erection of this bridge has already had a beneficial effect upon the population on the east side of the Borough of Manhattan. It has, in fact, revolutionized the unhappy conditions existing near the bridge in that borough. It will ultimately, in my judgment, be the means of shifting the population from the congested districts of the east side—or at least some of it—to more healthful and better homes elsewhere, with surroundings more agreeable, conditions more favorable and an environment more natural and wholesome in the outlying suburbs of this and the neighboring borough.

And here to-day, looking upon this splendid structure, so magnificent in proportions and in effect,

one which will stand for centuries to come, we must regard it as an ever continuing evidence of the genius and skill of the American people. It stands spanning a great river, the bosom of which bears daily and nightly striking evidences of our great commercial life. Under this structure will pass for centuries to come much of the commerce of our port and many splendid steamships will pass under it plying between domestic and foreign harbors; in a steady stream will also pass myriads of people seeking invigoration and entertainment along the shores of neighboring commonwealths. Upon it and over it from day to day and from year to year will pass thousands of our own people, happy and contented, citizens of a great country, loyal to the municipality, going to and from their peaceful and happy homes to the business centre of this great continent. There it will stand a monument to the genius and industry, as well as the progressive spirit of our municipality, ever mindful, as it always has been, of the comforts of its citizenship, and willing and anxious to advance their interests to the end that this great city may remain the chief metropolis of the country.

What of the future of Greater New York? We who are here to-day and who were present at the birth of this great city, realize what were the hopes and anxieties of its founder, to whose undying memory the

people of this municipality will be forever faithful. We have seen this great governmental power, as expressed through the charter, created, have witnessed the administration of public affairs under it, and while many defects can be found in the system which experience has gradually brought to the surface, and probably more will follow, can it not truly be said that entering upon this great life it has overthrown, to some extent at least, the fears and apprehensions of those who were opposed to its creation?

To-day we celebrate the welding of the second link connecting these two great boroughs, as we shall in a short time commemorate the opening of another bridge in the Borough of Queens and an increased service between Manhattan and Richmond. Let us hope that each individual borough will realize that its strength and growth depend not only upon the exercise of its own influence, but upon the strength and character of the municipality as a whole. Thus will have been accomplished a great step in the direction of unifying the city.

What the future of this great city may be is beyond the realm of man's mind to foresee. Broad, patriotic, philanthropic, it must pursue to the end the high mission intended for it. It is a city worthy of our best efforts. Its great prestige, its commanding influence,

its ever increasing power, should exact from us in its behalf our highest thoughts and best efforts. We are entitled to the best government that man can devise to be administered by the best people that can be chosen. Corruption and maladministration must be banished from our body politic. The evils of government which unfortunately have been found to exist in all municipalities must be eradicated. Instruments of governmental power must be selected not only because of party influence, or attachments—those should be the least of all requirements, indeed, if partisanship should prevail at all in their selection. There should be neither jealousy nor rivalry between the boroughs save that rivalry which tends to promote the common good of all.

I trust the time will never come when the great borough which I have the honor to represent to-day will ever be less interested in the growth of the other boroughs or less ready to extend financial or other help to them. I hope it will realize that what helps one helps all, and that the development of each is a contribution to the whole, and that as in the human body each organ should be carefully nurtured and defended, so in this great municipal body each organ as represented by a borough should be similarly guarded and protected.

To the other boroughs permit me to say in conclusion, that as Rome was not built in a day, neither can we in these modern times within a brief period build up Greater New York. That must be the result of a slow, steady and patient policy, and when exercised, it should be for the common good. But when in the course of time, after the development of the municipality has been gradually advanced, the civilized world will look, let us hope, upon a city leading the way in the solution of those great problems which concern all municipalities, with a people contented and prosperous, with a prestige unsullied and untarnished, with a manhood unexcelled and with a power for good unequalled.

HON. TIMOTHY D. SULLIVAN

HON. PATRICK H. MC CARREN

Senator McCarren's Address

THE event we celebrate to-day is one of great material and physical significance to the people of this section of the Borough of Brooklyn. The minds of many of the residents of our section will be carried back to the time when the agitation for the erection of what is now known as the East river bridge began. The public spirited business men and citizens of our community who organized themselves about thirteen or fourteen years ago for the purpose of expediting the legislation that resulted in the enactment of the law that provided for the granting of the original charter for the East river bridge and its companion, must feel that their work has been repaid by the consummation of the project in which we were all interested. I need not recount the various stages through which the legislation passed, and the amount of detail and work that was required to bring about the inception of this bridge building. It is sufficient to say that those who foresaw the necessity for quick and commodious communication between the island of Manhattan and Brooklyn, realized that we could not postpone the work except at the expense of the

development of this community. The geographical and topographical situation of Brooklyn renders it particularly available for business, manufacturing and residential purposes, and all that is necessary to make it ultimately the most populous one of all the boroughs of Greater New York is the supplying of facilities for traffic and pedestrian communication.

As soon as the bridge, the opening of which we celebrate to-day, is completed finally, with all its facilities for transportation by elevated and surface cars and its roadways for vehicle and other traffic, it will furnish the most impressive object lesson for the erection of other bridges as good, if not better, than this one. The improvements made in the work of bridge building render it comparatively easy to erect a bridge in a much shorter space of time than was formerly required, as illustrated by the difference of time required to erect the original Brooklyn bridge and the present one.

The march of business northward in the territory of the old city of New York must of necessity redound to the advantage of Brooklyn and its outlying territory, and whatever administration may be in charge of the affairs of our city, upon it must devolve the task of providing the means of travel and communication that will be necessary for the accommodation of our growing population. Statistics show us that the population of

Brooklyn increases one hundred per cent. about every twenty years. With all the advantages that can be given to Brooklyn by proper modes of travel and communication between it and the island of Manhattan, I think it will be found that Brooklyn's population will double itself in ten years, instead of twenty, as heretofore.

This event is calculated to arouse our sectional pride because of the fact that a study of the trend of travel from Manhattan to Brooklyn must indicate the speedy population and development of all that section of Brooklyn lying directly eastward of Brooklyn's terminus of the new bridge.

In common with all the other citizens of our community, I rejoice at this exemplification of the growth and prosperity of our borough and city and hail it as an evidence of the irresistible march of Greater New York and its boroughs in that direction that must inevitably lead to the position that New York is destined to occupy, namely, the first city of the world.

The Benediction

OUR help, O Lord, is in Thy holy name, who has made the heavens and the earth. Deign, therefore, O Lord, to give heed to our supplications, that Thou wouldst bless this bridge and all Thy servants who shall pass thereon, so that amid the prosperous as well as the adverse things of this world, they may be protected ever by Thy holy aid. In the name of the Father, and of the Son, and of the Holy Ghost. Amen.

The Building of the Bridge

A BUSY river bisects the most wonderful city that has ever been built in the history of the world. It is more properly an estuary of the sea. Its broad channel acts at one and the same time as an impediment and an incentive to imperial New York. The west shore of this so-called East river is Manhattan island, presenting on its lower end the places of industry and employment of the citizens of New York. Upon its east shore is the greatest community of homes extant. The East river acts as a natural barrier to hundreds of thousands of folk who have their employment upon Manhattan island. It is thus a great impediment to the growth of the present city of New York.

Yet its broad channel, despite fierce and marvellous tides, performs a very great service to this city in presenting it with many miles of available waterfront. It is essential that this waterfront, to remain available, must be easily reached by shipping of the largest class. Thus the handiwork of man in overcoming this natural water barrier is put to its highest test, and his skill must be exerted to the best of his ability.

LEFFERT L. BUCK

CHIEF ENGINEER OF THE WILLIAMSBURG BRIDGE

THE ENGINEERS WHO HELPED TO BUILD THE BRIDGE

Until a comparatively recent date communication between Brooklyn and Manhattan was crude and unsatisfactory, entirely limited to water craft, which in turn had its limitations from storm and ice and fog and tide. Years of thought coupled with steady and rapid advances in the sciences of iron working and cable weaving made the Brooklyn bridge possible, and when it was thrown open the residents of the two cities, that it made as one, were proud to refer to it as one of the seven wonders of the world. The bridge did not solve the problem of bringing Brooklyn across the East river each day, but the genius of the Roeblings, who designed it, made possible the other plans for overcoming the stream. Many bridge and tunnel schemes were put into shape, and work has been begun on some of them in the twenty years that have intervened since the opening of the Brooklyn bridge. The greatest of all present aerial structures, the Williamsburg bridge, has just been constructed, and its successful completion, after many discouragements, is the present occasion of much rejoicing. It is the greatest suspension bridge in all the world and quite surpasses the former "seventh wonder," a mile and a half below it, not only in size but in the details of its construction. It represents the progress of twenty years in the science of bridge-making.

The old city of New York had near grown gray with age and was a comfortable town of 61,000 persons before Williamsburg came into its being. At the very opening of the past century Richard M. Woodhull, a merchant of Manhattan, established a ferry from Corlears Hook to the foot of the present North Second street in Brooklyn. It was a horse ferry and a crude enough affair, with two miles of country travel through the DeLancey and Willett farms on Manhattan island before one came to New York city itself. Yet with supreme confidence Woodhull secured the services of his army friend, Col. Williams, who surveyed him a city on the east bank of the East River just above Wallabout Bay. The plan was thirty years ahead of its day and necessity. It then bankrupted Woodhull where only a little later it would have offered him the opportunity of amassing what was in those days a tremendous fortune. The only thing saved out of the Woodhull scheme was the neat pattern of the streets of the town and the name of Col. Williams, its designer, which was thereafter linked with the fortunes of Williamsburg.

The village grew apace. It acquired a church in 1808 and some eleven years afterwards a distillery. By 1820 it was a flourishing hamlet, with David

Dunham's steam ferry running between Grand street on either side of the East river, just as farther down the river the truly famed Fulton ferry served as the link between two streets of the same appellation. It became an incorporated village in 1827 and its brisk waterfront looked upon the transformation of the DeLancey and Willett farms into rows upon rows of smug brick houses. Its growth, barring a few set-backs, the direct result of over-speculation, was rapid and lasting. In twenty years it had become too big and cumbersome for a village government and the short-lived city of Williamsburg came into existence in 1852.

It was a quaint little town in those days, and even now a chance rambler about the streets adjacent to the Brooklyn plaza of the new bridge may now and then come to some old house, half hidden between tenements and warehouses, that must once have had gardens and rows of shade trees about its walls, or he may perceive some church, quaint in its old-time architecture, which seems to mourn the lost companionship of green fields and broad pastures. These are the lingering traces of an earlier day. They take the rambler in his thoughts back fifty years to old Williamsburg, which was becoming closely knit to Manhattan by the ferries from Grand street of that island to Broadway and Grand street in Williamsburg.

These two ferries were already important arteries of travel and since then their patronage has grown, not lessened, despite the constant addition of ferry routes from the foot of Broadway, Brooklyn.

After two years of separate existence as a city, Williamsburg in 1854 was made part and parcel of the old city of Brooklyn. Whether this step was premature, as has been urged by various historians, or was not, as has been insistently stated by their opponents, is immaterial here. The change was made and the rapid growth of Williamsburg was soon after checked. For a time this retarded progress was charged to the depressing influences that the Civil war brought upon the country. Afterwards this view was found to be erroneous. To properly understand the whole matter of growth it will be wise at this moment to study some comparative increases of population.

The city of Brooklyn was incorporated in 1834. It practically doubled its population in each of the decades from 1820 to 1840. It was at this last date no mean city and had about stepped into the position of third city in the Union in point of size. This place it held for more than fifty years thereafter. From 1840 to 1850 the increase was greatly enlarged and the growth in population was about 175 per cent. This

growth was maintained in the succeeding ten years. Every city in the country suffered a set-back through the Civil war, and its increase in size for the decade that covered that conflict was only 50 per cent. But the war over and the country once more in tranquil progress Brooklyn showed only 75 per cent. of gain in population from 1870 to 1880. In the two decades from that day to the present the growth has averaged 40 per cent.

Transportation facilities have hurt Brooklyn's growth and the lack of proper devices for handling large masses of people across the river undoubtedly did much to shut off the progress of that city as well as the increase of the large Williamsburg section at about the time of the opening of the war. Some slight improvement is to be seen upon the completion of the Brooklyn bridge, and the opening of the Williamsburg bridge will undoubtedly work a like improvement in the growth of the Eastern District which should add greatly to the ratio of increase in Brooklyn's population during the present decade. The enormous disproportion of the growth of Brooklyn to that of Harlem, for instance, may be shown in a single citation. The population of the old Twelfth ward of New York City increased 200 per cent. from 1880 to 1890 or, in actual figures, from 82,000 to 245,000. This growth was

stimulated by the completion of the elevated railroad and similar growths in upper Manhattan and The Bronx may be anticipated when the subway begins the operation of its trains a few months hence. The Williamsburg bridge and its neighbors that are

THE BROOKLYN ANCHORAGE

already under construction and the East river subway tunnel will serve to prevent these growths from becoming disproportionate and disadvantageous to Brooklyn.

The sudden stoppage of the increase of the population and the failure of old conditions of expansion to show

themselves, once re-construction and the panicky days of the seventies were well past, were puzzling to the Williamsburg folk. When the Brooklyn bridge was finished and Central Brooklyn and South Brooklyn began to receive practically all the growth that resulted therefrom, their view of the situation was illuminated. The idea of building a bridge for Williamsburg had been in the minds of some of its citizens for a long time. Two powerful arguments were now presented to them and, with the hard data of increases of population in several localities, the bridge question was taken up and not thereafter allowed to die. The entire district was educated to believe that the bridge was its salvation. It looked for leadership to bring the plan to a successful end.

Even before the Brooklyn bridge was opened, in the spring of 1884 the bridge agitation in Williamsburg was coming to a head. A meeting was held May 3, 1883, at the house of Ambrose Snow, 11 Bedford avenue, to initiate a movement for the improvement. Among those who gathered at that time to further the project were Col. Andrew D. Baird, William H. Gaylor, ex-Judge George Thompson, Bernard Peters, Frederick Scholes, George H. Fisher and William B. Hurd. Nothing of a definite character was accomplished and the matter lay dormant for several

years. It was not until 1887 that it received the consideration of the legislature. In the spring of that year, Assemblyman Thomas Farrell, of the old Sixth district, introduced a bill designed to promote the construction of a bridge or tunnel at approximately the present site of the Williamsburg bridge. The bill was passed. It was an indefinite sort of instrument and not being seconded by constructive measures, brought no results. It was two years later when State Senator Patrick H. McCarren, who as a boy worked as a cooper in old Williamsburg and who loved the old town and all its turns, started his long battle in the Albany legislature for the building of the bridge. He found that he had not only the powerful ferry interests to fight, but also that the old city of New York was unwilling to assume one cent of the cost of the proposed structure. This early McCarren measure provided that Brooklyn should pay two dollars where New York paid one for the span, but it was defeated. It was followed by a host of bridge measures at Albany until the Williamsburg folk began to feel assured that in some mysterious way or other they would receive a bridge from all the chaos. Most of the proposed enactments were devised with some private end. They all failed one by one and Senator McCarren, not daunted or dismayed, began to look to a new quarter for the accomplishment of his purpose.

The elevated railways of Brooklyn had, fourteen years ago in the minds of the men that then owned them, nearly reached the limits of their possibilities. Frederick Uhlmann, who was at that time a large owner of these properties, foresaw that their only hope for extensive development lay in their being brought, not only to the soil of Manhattan island, but in being placed for a long enough distance thereon to serve a considerable manufacturing and business district. It was his idea that the best service, so far as the interests of Kings county were concerned, would be obtained by a railroad crossing the East river near the Grand street ferry and continuing across Manhattan island to West street. The Brooklyn Union Elevated railroad owned a good structure the entire length of Broadway in that city which connected with the other lines of its system and extended well out upon the backbone of Long Island. Mr. Uhlmann, with the aid of O. F. Nichols and some other well known engineers, planned not only an East river bridge at Grand street ferry but a returning bridge crossing the river from a point near Gouverneur slip to a location in Brooklyn just south of the Navy Yard, where an easy connection could be made with the existing elevated structure in Hudson avenue. Such a scheme is very similar to the loop service which has been proposed

from the Brooklyn bridge to the Williamsburg bridge along Centre and Delancey streets, Manhattan, and which is so earnestly advocated by the Brooklyn Rapid Transit interests at the present moment.

The plan for the two bridges as devised by Mr. Uhlmann was carried into the legislature in the winter of 1890-91 and met with a lively opposition, led again by the ferry interests. This served to defeat the scheme

THE MANHATTAN SHORE PREVIOUS TO STARTING THE BRIDGE

and it was not until the following session that Senator Patrick H. McCarren, of Williamsburg, and Assemblyman Timothy D. Sullivan, of Manhattan, who were fathering the project, were able to secure a favorable legislative enactment. They achieved the passage on March 9, 1892, of the McCarren bill, known as Chapter 102 of the laws of that year, which incorporated the East River Bridge company for the purpose of

building the two bridges. The structure that followed the line of the Grand street ferry must of necessity be a suspended span and was to carry, in addition to the elevated railroad tracks, carriage and foot-ways which were to curve on the Manhattan approach underneath the elevated tracks and approach the surface on the north side of Grand street between Sheriff and Willett streets. The elevated railway was to continue across Manhattan island to West street, going over the structures of the Manhattan railway. A branch elevated line was to have been deflected at the Manhattan approach and, following Scammel street, was to have recrossed the East river on the second bridge to Hudson avenue, Brooklyn. This structure could be made a cantilever span if the company so wished and was designed to carry elevated trains alone.

The plan for building the Brooklyn elevated railroads across Manhattan island killed the whole scheme. Tremendous interests fought the extension of a Brooklyn transportation line to the Hudson river and the project was strangled in the courts early in 1894. Nevertheless the plans for the bridges had tremendously excited all the folk of staid old Williamsburg, and the downfall of one project was only the signal for renewed public sentiment favoring the building of

the bridge. Senator George A. Owens of Williamsburg led the ranks of those who urged the necessity of the improvement and he found in Timothy D. Sullivan, as Senator McCarren had found him, a most loyal friend and fellow-fighter. Other interests in Williamsburg were awakened. The executive committee of the People's bank considered the plan quite within its province and with the aid of Congressman Charles G. Bennett, the two Albany legislators just mentioned and a host of loyal helpers, the People's Bridge Association was brought into being on April 2, 1895. Committees of workers from this association, which has its echoes of to-day in the many boards of trade and business men's organizations of Williamsburg and Bushwick, formulated new bridge plans with celerity and that very spring the matter was again taken to Albany. Quick legislative results were noted. Before that month of April had come to its close a bill drawn by Mayor Schieren of Brooklyn and introduced by Senator Owens had been put through Senate and Assembly providing for the appointment of an East River Bridge commission by the mayors of the former twin cities of New York and Brooklyn. This act was approved by Governor Levi P. Morton on the twenty-seventh of the following month and it became Chapter 789 of the laws of 1895. Hardly had the ink of the Governor's signature dried before

the mayors of the two cities were acting under its provisions.

Mayor Strong, of New York, appointed Salem H. Wales, Francis B. Thurber and Richard Deeves as his members of the commission. Mayor Schieren, of Brooklyn, who was one of the most enthusiastic promoters of the bridge scheme, named as his appointees Andrew D. Baird, James A. Sperry and Henry Batterman of that city. The commission organized itself without delay and elected as its first board of officers, Andrew D. Baird, president; Salem H. Wales, vice-president; Francis B. Thurber, secretary, and Richard Deeves, treasurer. It chose as its counsel ex-Judge William G. Choate, of New York, and H. C. M. Ingraham, of Brooklyn. The bridge was officially named the East river bridge. Since that time the more graceful and distinctive title of Williamsburg bridge has been substituted.

The East River Bridge commission—which included as ex-officio members the mayors of the two cities—found that among its duties as provided by the legislative enactment was the purchase by mutual consent or by condemnation from any corporation that should possess a valid charter, the right of that corporation to construct such a bridge as was then contemplated, across the East river. This brought the East River Bridge company with its unquestioned rights before

the eyes of the commissioners. Mr. Uhlmann made a flat or upset price of $650,000 for the company's franchise to build a bridge from Grand street, Manhattan, to Broadway, Brooklyn. He also made a conditional price of $250,000 in consideration of which the com-

BUILDING A CAISSON ON SHORE

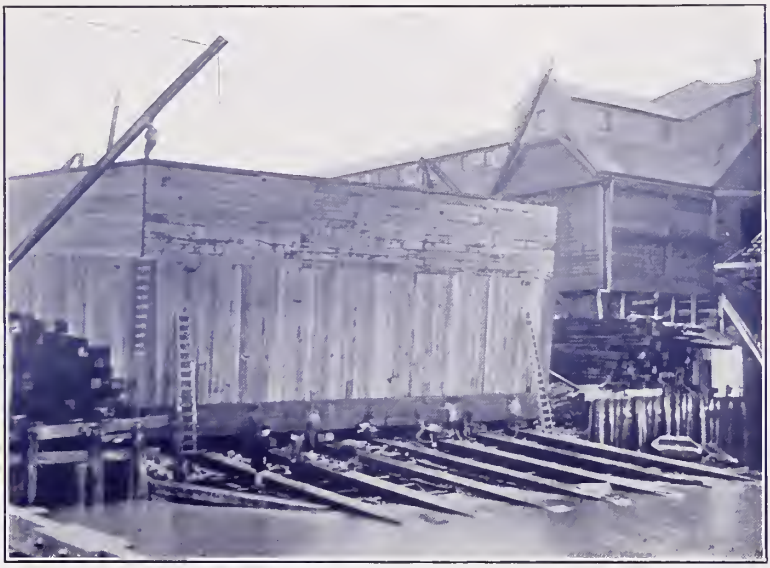
mission would agree that the trains of the Brooklyn Union Elevated railroad should forever be allowed to cross the bridge free of all tolls. The commission rejected both offers and threatened condemnation proceedings. Mr. Uhlmann finally offered for $200,000 the rights of the East River Bridge company. Rather than delay the completion of the much needed

improvement by a two years' legal tangle, the commission accepted this offer and thereafter proceeded with a free hand and no interference.

It selected as its chief engineer Leffert L. Buck, to whom was accorded the honor of designing the new bridge. Mr. Buck was a civil and mechanical engineer of vast experience. He had planned and built some of those marvellous Peruvian railways that one moment pierce the very hearts of the mountains of the Andes and the next are carried over chilly chasms on the most difficult bridge construction known to the history of engineering. He had built two of the great bridges at Niagara Falls. In every way he seemed equipped for the work set before him within this city. He attacked his problem with vigor and with the skill that is partly born of long experience. O. F. Nichols, to whom reference has already been made, became his assistant. The engineers were appointed in August, 1895. Within a very few weeks they were at work on the studies, surveys and preliminary plans.

The legislature at Albany had protected the Broadway ferries in Brooklyn by statute, and in order to avoid the destruction of the great Havemeyer sugar refineries in Williamsburg, practically one block alone was left for the bridge landing there. This extended along the water front from South Fifth to South Sixth

street and was occupied by one-story warehouses. The plot was purchased two years later from the American Sugar Refining company for $350,000 and to-day is directly beneath the Brooklyn end-span of the bridge. It was found impossible to build the bridge directly across the river from this necessary plot in Williamsburg so as to give the shortest possible water-span



THE CAISSON READY TO LAUNCH

without interfering with ferry property on the Manhattan side. The interests there, however, were finally conciliated by an exchange of realty and the bridge brought across the stream in the shortest way, the north side of the structure just touching the south side of Delancey street. When the original plan of

the old East River Bridge company to bring roadways and footpath to the Grand street terminus between Sheriff and Willett streets had been abandoned by the commissioners because of the sharp curve and steep grades that it involved, the route of the proposed bridge was straight save for a slight curve at the extreme eastern end of the structure. This curve was for a long time on the working plans of the commission. Finally the desire for an absolutely straight bridge from end to end coupled with the plans for the Brooklyn plaza made this kink undesirable and the legislative action was obtained that enabled the commission to remove it.

Congressman Bennett's attention was largely fixed upon obtaining the consent of the War Department at Washington to the building of the bridge and this was secured upon certain conditions imposed by the United States Harbor-Line board, which has direct charge of such matters. That body decreed that the height of the bridge should be the same as that of the Brooklyn bridge, 135 feet in the clear above mean high water of spring tides, but extending for a distance of 400 feet in the center of the water-span. This 400 foot distance was probably reached by considering the plane of the clearance heights of the East river bridges as a triangle, 135 feet above high water,

with its apex at the middle of the old bridge and its base at the Ravenswood bridge over Blackwell's island, where the 135 feet of clearance is equal to the full width of the river.

This arbitrary figure, fixed by the army engineers, was a factor in determining the grade of the bridge on railroads, paths, and roadways. The grade on the roadways and the surface car tracks was fixed at approximately 3 per cent., and this carried the straight approaches to a point 200 feet east of Driggs avenue, Brooklyn, and just east of Clinton street, Manhattan. The ground being about 20 feet lower at both terminals than was the case at the location of the Brooklyn bridge, the Williamsburg bridge is about 1,200 feet longer than its predecessor or approximately 7,200 feet over all.

These details kept Mr. Buck and his associates busy for long weeks and months while the diamond drill, which bores with wonderful accuracy, was making soundings at the sites selected for the foundations of towers and anchorages. The general plans for the structure were finally filed, on August 19, 1896, in the Departments of Public Works in each of the twin cities. They had been carefully prepared under the oversight of Mr. Buck and bore the official endorsement of the commission. Based upon these plans the cost of the

proposed bridge was then estimated at $7,000,000 and five years were allotted for the completion of the work. This time allowance was exceeded by a single twelve-month and this excess was entirely caused by a somewhat disastrous fire near the completion of the work and vexatious delays in the tower building and cable weaving over which the bridge engineers and the commissioners had practically no control.

The filing of the plans was followed by a preparation for the awarding of the contracts for construction which, as in all enterprises of this magnitude, were separately allotted for different phases of the work; the foundations of each of the towers, the construction of each of the masonry anchorages, the steel framing of the towers, the stringing of the cables, the building of the end-spans and centre-span and the erection of the steel latticed anchorages. Best progress was made in the preparation of the detailed plans and specifications for the Manhattan tower, and in September, 1896, advertisements were made for proposals for the erection of that first step in the construction of the Williamsburg bridge. Twelve well-known contractors responded and from them the award was finally made to P. H. Flynn, of Brooklyn, the lowest bidder, for $327,000. He commenced preparations at once upon the awarding of the contract on October 28. On

November 7 the first actual construction work on the new bridge was recorded, but so quietly was the work prosecuted at that time that many and many a citizen crossing the East river at that point on a stumpy ferry-boat did not realize that the fleet of noisy tugs and dull barges which surrounded a group of derricks represented the sinking caisson of the north pier of the Manhattan tower.

The caisson system is practically the only method of securing the under-water work on bridge construction on a river of depth and it was successfully prosecuted in the building of the Williamsburg bridge. The Western river type of caisson was chosen for work and the structures were built of wood, the Manhattan

LAUNCHING A CAISSON

pair being stiffened with steel trusses on account of the great depth of mud in which they were to be sunk In these caissons the roof of the working chamber is

TOWING THE CAISSON INTO ITS FINAL POSITION

comparatively thin and then they are built up with timber to a considerable height and filled in with concrete upon which the masonry rests at what is the normal bed of the river. The caissons—the men working like water-rats in the shallow air-locked chambers—are sunk to a considerable distance below the normal bed or until they rest almost, if not completely, on the solid rock. The maximum depth in this marvellous system of under-water burrowing, which has called admiration to American engineering methods from all quarters of the world, was 110 feet at the northwest corner of the north caisson on the Brooklyn side. The

excavation was carried about 10 feet below the metal cutting edge of the caisson at that point. The air for the men who were imprisoned beneath these great structures as they worked with pick and shovel upon the bottom of the river, was forced by two duplex compressors and was cooled in summer by being passed through about 3,000 feet of pipe placed beneath the surface of the water in the river. None of the men, who enjoy the entertaining sobriquet of "sand-hog" and worked in the caissons, suffered serious injuries. They were paid according to a scale of wages made by mutual agreement with their employers and received remuneration for their work after this scale:

For all depths up to 55 feet, $2.75 for eight hours work.
For depths from 55 to 70 feet, $2.75 for six hours work.
For depths from 70 to 80 feet, $3.00 for two hours work.
For depths from 80 to 90 feet, $3.25 for one and a half hours work.
For depths over 90 feet, $3.50 for one and a half hours work.

The "sand-hogs" were not permitted to work more than the allotted time each day and divided the work into two shifts with an hour's rest between shifts. The

engineers and contractors who built the tower foundations found it very difficult to get enough experienced men to work at the great depths to keep the enterprise moving continuously.

THE CAISSON ANCHORED AND READY TO SINK

While Contractor Flynn was making these first steps upon the actual work for the big structure, the East River Bridge commission was exercising its second great function. It not only had to build the bridge but it also had been empowered by the legislature to secure the land upon which it was to stand. It was decided to leave a clear space on both sides of the bridge of at least 32 feet in order to protect the

structure from fire or accident to adjoining buildings. This necessitated the acquisition of property, 150 feet in width, along the south side of Delancey street, Manhattan, from the river's edge back to Clinton street, and a similar broad strip extending back into Williams-

PLACING THE MASONRY ON A CAISSON

burg from the shore. Plazas were also planned at each of the terminals of the bridge. The Brooklyn plaza is already cleared of buildings, effecting a complete transformation of that central portion of Williamsburg. The Manhattan plaza is smaller and is now in condemnation proceedings. The commission worked for a time in land acquisition as best it might. Many times land purchases were made at private sale where figures were reasonable and condemnation

proceedings obviously would be expensive as well as fraught with delay for the enterprise. In these cases it found that property owners realized that the inevitable in the shape of a great bridge was about to descend upon their realty. After a time, however, the courts

FINISHING THE MANHATTAN PIERS

interfered with this simple and business-like method of progressing with the work and the commission was compelled to acquire all of its realty through condemnation. The buildings that stood upon the needed land were auctioned off upon conditions of quick removal and formed rare prizes for the house-wrecking concerns in which the city abounds. In this ruthless way, which may only be compared with the devastation wrought by a tornado or a sweeping fire, homes that sheltered

families for generations, corner stores that were landmarks, places of worship that had become endeared to the members of their congregations were taken off the earth and into history. The bridge was no respecter of persons nor of property. Anything that stood in the path of its straight course suffered. In one case the stage of a Brooklyn theatre occupied a part of the strip of land needed for the approach on that side of the river. It was demolished at the fire-wall which divided the proscenium from the stage and the opening in which the drop curtain hung was bricked up. It is now proposed to utilize the structure, which has its auditorium still intact, as a lecture hall. Other changes, unique, sweeping, devastating, were made on both sides of the river as soon as the condemnation commissioners announced their rulings.

The summer of 1897 saw great activities at the site of the Williamsburg bridge. The stone masonry and the concrete work on the north pier of the Manhattan side, where the initial caisson had been sunk, were being laid and its twin caisson launched. Early spring saw advertising for bids for the construction of the Brooklyn tower foundations. There was lively response to the invitation of the commissioners and nine contractors submitted offers for the work. The award was finally made in June to Colin McLean, of

THE PIERS RECEIVE THEIR TOP COURSES

Manhattan, the lowest bidder. His contract figure of $507,187 was accepted.

Mr. McLean, whose interests were soon merged with those of the Degnon-McLean construction company, commenced his work promptly. The Brooklyn caissons were erected on the shore of the river upon the property purchased from the American Sugar Refining company, just as the Manhattan caissons had been built on the shore and afterwards launched. The Brooklyn caisson problem was more difficult, however. There is an enormous sweep of current and an accelerated force of tide at the very point where it was proposed to sink them. River pilots know that turn just above the Wallabout and avoid it, while the captains of

the ferry lines that land at the foot of Broadway, Williamsburg, often have difficulty in bringing their stubby craft to a landing there.

The caissons were made large enough to allow for a slight misplacement by the stress of tide and current and yet to permit an accurate placing of the masonry of the tower. The south caisson was launched on September 30, 1897. A fleet of tugboats, taking advantage of the lull at changing tides, placed the unwieldly structure with some little trouble. It was finally anchored in position with a success that had hardly been expected and, once protected by a high cofferdam, the anticipation of trouble at that point of

THE FOUNDATIONS FOR AN ANCHORAGE

the bridge-building ceased. It was a comparatively easy matter to place the north caisson in the following December, for the south caisson with the beginnings of the masonry made a firm protector and barrier against the brunt of river force.

Soon after this north caisson had been sunk there came to the two cities upon the shore complete political

THE NEARLY COMPLETED ANCHORAGE

changes which had their reflection in the government of the embryo bridge. Old boundaries were swept away, Brooklyn buried her individuality as a city and the Greater New York, which had been a dream of far-sighted publicists for a score or two of years, became at last a reality. The boundary changes on January 1, 1898, were accompanied by a change in administration

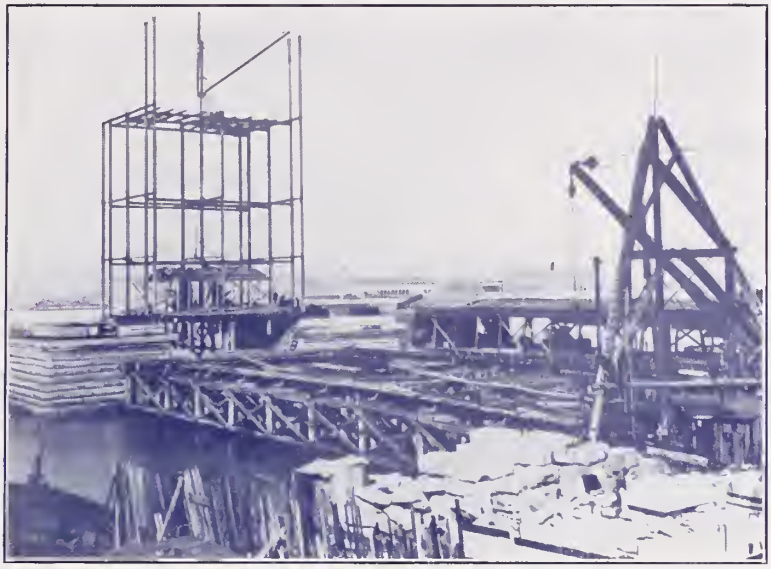
which resulted in radical differences in the *personnel* of the East River Bridge commission. The original board, which had served since the inception of the scheme, was succeeded by six new commissioners, who were appointed by Mayor Robert A. Van Wyck on January 19. These were: Lewis Nixon, James W. Boyle, Smith E. Lane, Julian D. Fairchild, John W. Weber and Thomas S. Moore. Mr. Nixon succeeded Col. Baird as president of the commission, Mr. Boyle became its vice-president and Mr. Lane its secretary. The office of treasurer was discontinued and payments on the work were made by the city's financial department upon the approval of the newly created Board of Estimate and Apportionment. This change in the financial scheme of the commission was made, as were many other similar changes throughout the town, with an idea of securing uniformity in the city's financial methods. In the case of the Williamsburg bridge, at least, it worked havoc and caused great delay. Soon after the new commissioners assumed office they were forced to stop work on all portions of the bridge, while the Finance Department tried to ascertain whether the city could borrow the necessary money to proceed with the enterprise. The legal knots were finally untangled and the work resumed after this interruption.

The fact that Chief Engineer Buck's name was to

become linked with the building of the Williamsburg bridge, just as the names of the Roeblings were linked with that of its predecessor, was recognized by the new commission, and together with Mr. Nichols, his right hand man and chief assistant, he was continued in practical charge of the bridge building. The structure at that time was practically two separate constructions a half mile apart, so resident engineers were appointed on each side of the channel. E. G. Freeman was made resident engineer on the Manhattan shore and E. Duryea, Jr., filled a similar position in Williamsburg. Both young men worked with energy and with success. Mr. Freeman's connection with the bridge soon ended. He fell ill in 1899 and soon after died. His loss was keenly felt by all the men employed on the works. Another young man, who afterwards came to have much to say in regard to the bridge, was head draughtsman of the engineering corps. He was Holton D. Robinson, who is at present the engineer in charge of the work.

The work of building the anchorages followed close upon the heels of the piers. The contracts were awarded before the original commissioners retired from office and work commenced soon after President Nixon and his associates came in charge of the bridge. After spirited bidding Shanly & Ryan, of Manhattan, were

given the contract for the Manhattan anchorage, while the Degnon-McLean company were intrusted with the building of the corresponding structure in Brooklyn. The price paid for building the Manhattan anchorage was $730,770, while the Degnon-McLean company



READY FOR THE STEEL TOWERS

were given $723,528 for that phase of the work in Brooklyn. Poor foundation soil was found at the resting place for the Manhattan anchorage, which necessitated the driving of 3,500 piles and added materially to the cost.

The anchorages are huge piles of concrete and limestone masonry, faced with granite above the ground, and are built to resist the pull of the cables. They differ

only in detail, and so immense are these constructions that were their massive walls built to enclose the floors of some building, that building would be ranked as one of the very largest in this city of gigantic structures.

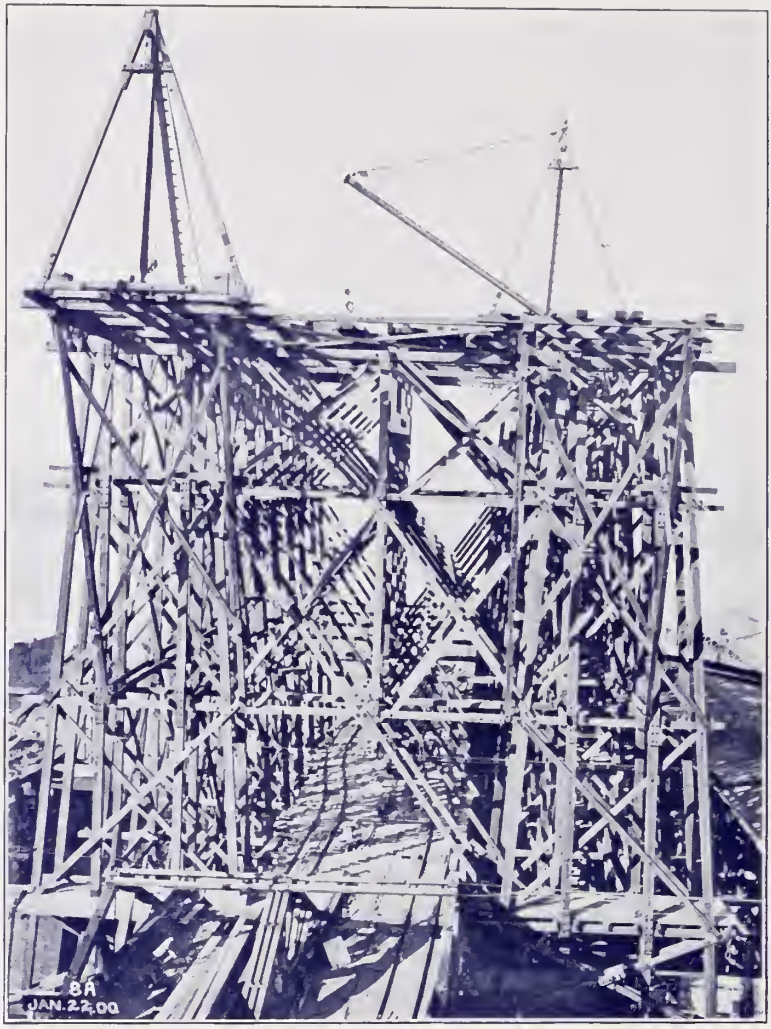
ERECTING THE FALSE-WORK FOR THE END-SPAN

They appear externally as solid masses of masonry but are cored out wherever practicable to secure an economy of material. Each is intended to resist overturning or sliding on its base under a pull of 20,000 tons transmitted through the cables. Both anchorages rest on heavy grillages of timber overlaid by great masses of concrete upon which the stone masonry is placed. Each contains about 1,700 tons of steel, most of this being

in the cable chains and in the anchorage platforms for the chains.

These chains are attached to the ends of the wire cables that cross the river and support the suspended structure. They are composed of the eye-bars, which have been a continued subject of discussion in their relation to the Manhattan bridge, and are hidden within their anchorages. They are anchored to twelve ton castings that in turn are secured by the anchorage platforms. These platforms are built up of steel girders, nearly 6 feet deep and 24 by 36 feet in area, for each of the cables. The eye-bars of the cable chains, 1,516 in each anchorage, pass between the girders of these anchorage platforms. The whole forms an unyielding mass. When the erection of the bridge was completed and the full weight placed upon the four cables the eye-bar chains were elongated to their permanent length under load. Then concrete was packed about the entire construction, making an anchorage of great strength and impenetrability. It is probable that the anchorages would resist more than twice the strain that will ever be placed upon them. Almost any other portion of the bridge could be overstrained to breaking before they would show the slightest effects from the abnormal stress.

Once the financial questions involving the building



A CLOSER VIEW OF THE FALSE-WORK

of the bridge were settled the work was prosecuted with vigor. The Manhattan piers were finished and their Brooklyn twins were only slightly behind in the making. The year which brought the war and all the

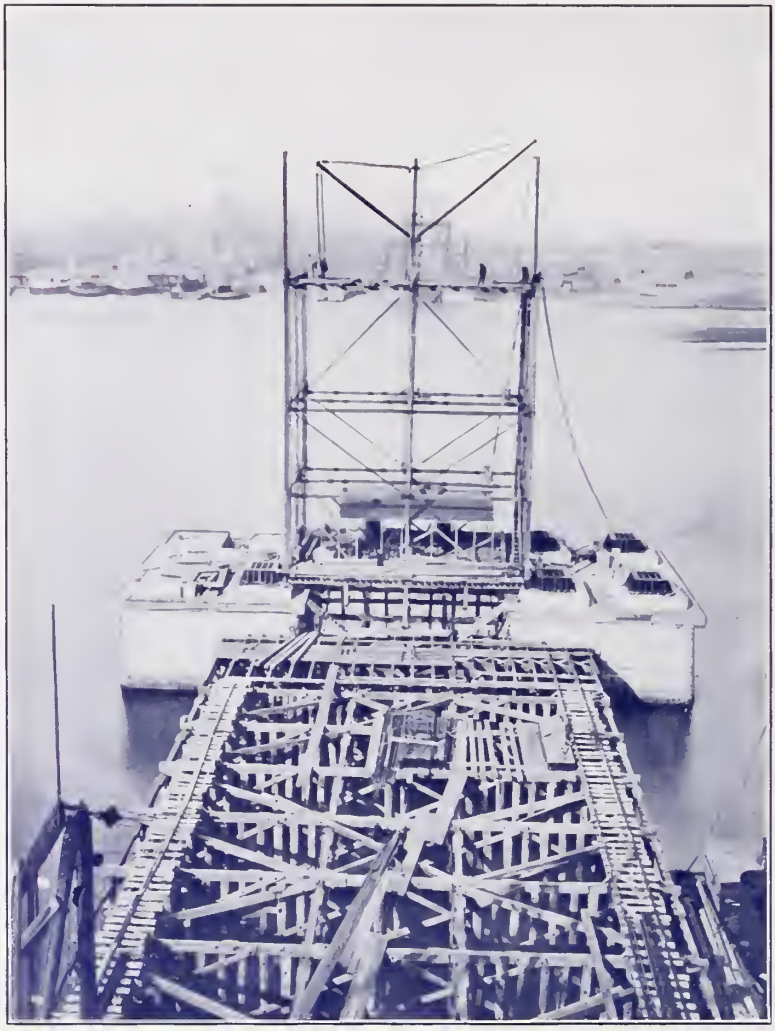
consequent excitement in the nearby Navy Yard as well as brought great local changes, passed into history and 1899 was born before other radical steps were taken in the construction of the Williamsburg bridge.

The contracts for the building of the steel towers and the end-spans, which were logically the next step in the process of the work, were awarded February 21, 1899, to the New Jersey Steel and Iron company for $1,220,230, and the shops of that corporation were at once put into commission to shape the product of the rolling mills so that the steel work would be ready to place upon the raising of the anchorage walls to the height of the deck of the bridge.

The chronology of the bridge at this time was interrupted by the death of one of the commissioners, Thomas S. Moore, of Manhattan. Mr. Moore died April 1, 1899. Ten days later Mayor Van Wyck appointed James D. Bell, of Brooklyn, as his successor. On June 15, of the same year, the commission elected Mr. Bell as its secretary to succeed Smith E. Lane.

A retrospect of the work on January 1, 1900, showed almost all of the steelwork for the tower and end-spans on the ground and ready for erection. There had been great delays in the delivery of this steel and, as heretofore stated, delays in the tower building have been one of the chief causes for hindrance in the com-

pletion of the bridge. On that same day a report issued by the East River Bridge commission showed that the contracts let up to that time aggregated $3,619,823.46, while $908,256.50 had been expended in the purchase



PLACING THE BASES OF THE STEEL TOWERS

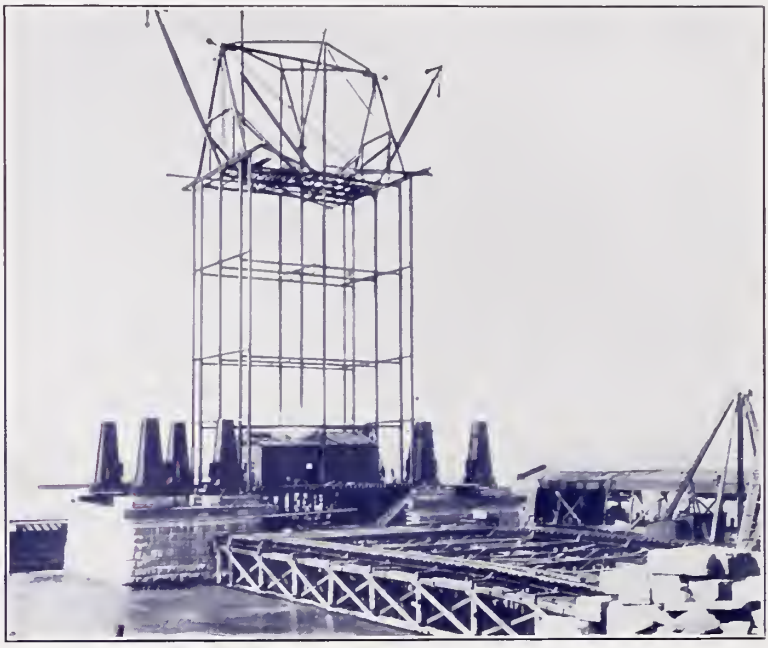
of real estate. The bridge bonds then sold amounted to $5,255,148.16. On the structure in real estate and in completed construction and on the expenses of the commission and its engineers $3,466,338.45 had actually been spent.

The steel cable contract was awarded at that time to John A. Roebling's Sons, of New York, for $1,398,000. This contract involved the manufacture and erection of about 5,000 tons of steel wire and castings. In many ways it was the most important award in the construction of the bridge and great care was taken by both the commission and its engineers in regard to the matter.

Within a few months thereafter the great steel towers that were to bear these cables far aloft were started from the stone piers that had been finished long months before. The cast steel pedestals of four out of the eight columns of each tower were laid on each pier. Each of these pedestals weighs 11 tons and each is fastened to the stonework by four anchor bolts, 7 feet long and 3 inches in diameter.

Before the ironworkers brought the towers into being, raising the eight-foot columns step by step, a host of carpenters had started one of the two most important temporary phases of the work. Timber falsework was erected from each tower back to the

anchorage and at almost the height of the roadways. Upon this false-work, which necessarily was very heavy and strong, a traveler was erected for the building of the trusses of the end-span. These spans support themselves, resting at either end on tower



THE PEDESTALS OF THE TOWERS FOLLOW THE BASES

and anchorage, with additional support midway upon a roller bearing of an intermediate tower the same width as the main towers, but only extending as far up in the air as the end-spans. Once the main towers were brought well above the level of the roadways, or the deck of the bridge, travelers were placed

in position on the false-work and the work of erecting the end-spans carried forward with dispatch. The towers continued upward into the air until they became objects commanding attention by reason of their very great height and offering to those lucky folk who

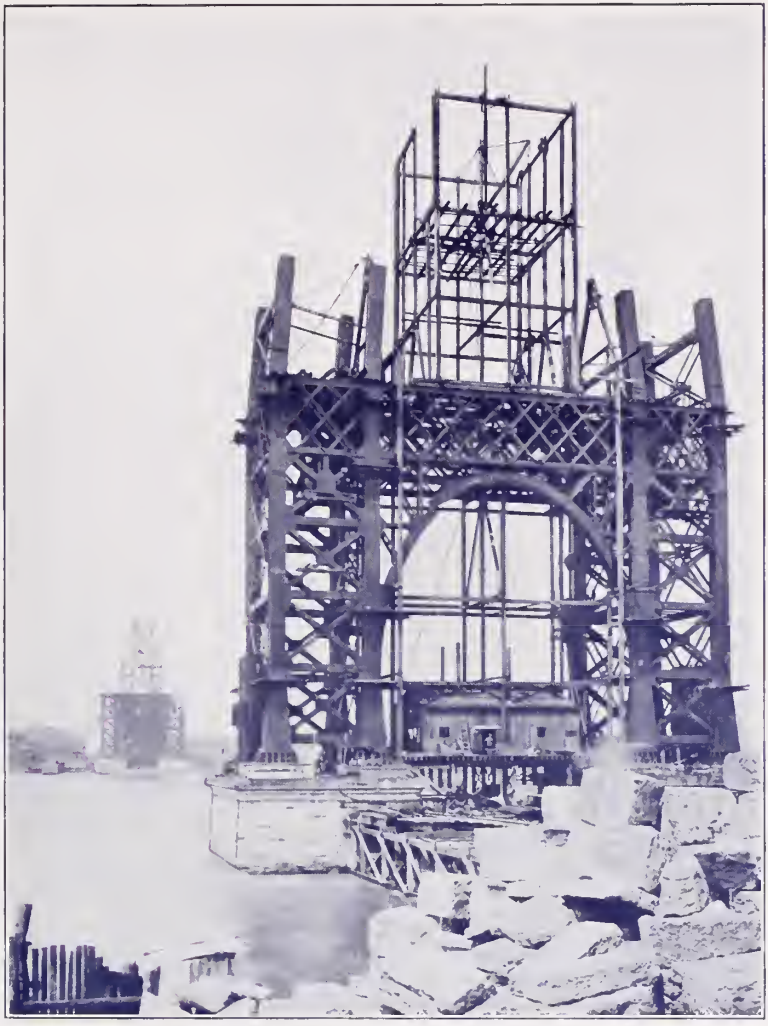
THE TOWERS REACH THE LEVEL OF THE ROADWAYS

managed to attain their tops a panoramic view of rare interest and beauty.

The final contracts for the remaining important parts of the Williamsburg bridge, the approaches, were being considered as the roller castings to carry the four great cables were being placed on the bridge tops. These awards were made to the Pennsylvania

Steel company and were finally given October 18, 1900. The contract price for the long Manhattan approach, with its 12,000 tons of steel, was fixed at the bid of $1,464,000, and the price for the shorter Brooklyn approach, with 6,000 tons of steel, was similarly fixed at $947,000.

The approaches are simply steel viaducts, 1,280 feet long in Brooklyn and 2,070 feet long in Manhattan, terminating in masonry structures where the grade comes near the ground; at Bedford avenue, in Brooklyn, and at Ridge street, in Manhattan. They end with flourish and pomp as well befits so big a bridge, and in all probability will never be loaded down with such terminal stations as have always disfigured the Brooklyn bridge. The approaches would be things of great beauty and distinction, from their impressive size, were not their attractiveness marred by a single feature. In order to give an easy grade to the two elevated railway tracks, which have the exact centre of the bridge and which were planned for the poor hill climbing proclivities of steam locomotives, the tracks are at the deck of the bridge along the centre span and are brought well up into the air above the roadways on the approaches. The substitution of electricity for steam on the railways of the city may yet render it possible to remove these ungainly midair structures



THEN MOUNT UPWARDS INTO THE AIR

and provide some sort of subway connection that will be more befitting the dignity of this monarch among all bridges.

Towers and end-spans in position, all was ready in

the hot summer months of 1901 for the bringing of the first wire across the river and making the earliest physical connection between the two parts of the bridge that had already been years in building. There is probably in the whole science of bridge-building nothing that is more fascinating than the cable-making of a great suspension bridge. To a layman at least this weaving of the web, this tangible bridge growing before his eyes atom by atom, thread by thread, is both real and dramatic in the extreme. Kipling has written of the thrilling work of erecting a cantilever bridge. If Kipling had crossed the East river on the Twenty-third street ferry during the fall of 1901 or the spring of 1902, he might have spun another romance upon the spinning of the bridge.

A float, convoyed by a shrieking and flag-bedecked tugboat, crossed the river on August 11, 1901, and was greeted enthusiastically by the harbor craft. On the deck of this float was a giant spool, and as it slowly revolved it left a single wire extending from the Brooklyn tower pier to the Manhattan tower pier. It was only a few minutes' work to raise the ends of this wire to the tops of the towers and then so to adjust its curve that it would very closely follow the curve of the cables of the completed bridge. The bridge-builder calls that centre dip of his cables from tower to tower the versine of his structure.

THEIR CONSTRUCTION ADVANCES

Other wires followed this first and a few days later the Roeblings' workmen, cautious fellows each of them, bound these into eight temporary cables from anchorage to anchorage, and at each edge of the projected

bridge erected a light foot-bridge which extended from the Manhattan anchorage to the Brooklyn anchorage over the top of the towers. These twin foot-paths were connected by cross-bridges at short intervals and the whole temporary structure was fastened by various guy cables and braced against the wind.

That was a real bridge across the East river and a source of delight to such sturdy and daring folk that were permitted to cross it. It was erected for the men who were to build the permanent cables, which are the very bone and fibre of the bridge. The twin structure was ready in three months from the time the first wire had been carried across the river.

At the end of the cable chains, which have already been described, are a set of cast-steel shoes, each about 16 inches in diameter. These are the buttons upon which the wires of the cables are fastened. It takes 7,696 wires —each wire 3-16ths of an inch in diameter—to make a single cable. The wires are assembled in strands of 208 wires each, 37 strands in all, and to each strand is given an individual shoe. The wires are perfectly straight and laid parallel to each other and are wrapped first into the separate strands and finally into a solid circular mass, about 18 inches in diameter. Each wire as delivered from the factories in Trenton, N. J., was about 3,500 feet long, but these were so

UNTIL THEY NEAR THE TOP

spliced that each strand is practically a single wire doubled upon itself for 104 times and passing over the rounded edge of the shoe without breaking or losing its continuity.

Guide wires suspended just above the temporary bridge showed the final location of the cables. A four-foot grooved wheel, known in the parlance of the bridge-builders as the "traveler," worked back and forth along the guide wires, one "traveler" being assigned for the building of each cable. With one end of the wire held in position at the anchorage, the bight was placed upon this wheel and carried to the anchorage and shoe upon the opposite shore, some 3,000 feet away. Thus, two wires at a time, the strands were laid and secured to the shoes. When the "traveler" had crossed the river 104 times the strand was complete and the wire-end that had first been held was spliced to the remaining and free end of the wire. Then the strand was practically one wire, endless and approximately 325 miles long. When the "traveler" had spun the other strands they were gathered together and castings placed upon them at about 20-foot intervals, for receiving the doubled ends of the perpendicular suspender cables which bear the entire weight of the centre-span of the bridge. Between the suspenders the main cables are covered, after having been filled with a greasy compound, with thick canvas strips under thin shields of sheet steel. Each cable, when completed, weighs 1,000 tons and bears a load of five times its weight.

Cable-making is more quickly related than executed, or than was executed on the Williamsburg bridge, at least. Through the early summer of 1902 the cable-making dragged woefully. It was a sort of sad bequest to a new administration from the former East River Bridge commission. The commission had ceased

AND ARE READY TO BE CAPPED

to exist when 1902 was born. Another of the frequent Albany changes in the city charter had legislated the old board out of life and had turned the more than half finished bridge over to the mercies of the Department of Bridges. Mayor Low appointed Gustav Lindenthal as the commissioner in charge of that particular department of city administration, and Mr. Lindenthal was very much annoyed at the delays shown by the Roeblings in executing their contract. When

the expiration of the contract came to pass and the cable-making was months from completion, the bridge commissioner, Mr. Lindenthal, deducted the penal sum of $1,000 a day for the delay from the payment to the cable concern. The delay was considerable and the total fine exceeded $175,000. The matter is at present being fought out in the courts between the Department of Bridges and the Roeblings.

In August of last year the cables were complete and the preparations to hang the "suspenders" went ahead without greater delay. This work was well in hand by November, and the bridge engineers foresaw an early completion of the structure and its being thrown open for traffic in the summer of the present year. H. D. Robinson, who has been mentioned before in this sketch, and Kingsley L. Martin, whose father, C. C. Martin, was for many years the guiding spirit of the Brooklyn bridge, became more actively associated than before with the progress of the work. They were equally optimistic with Mr. Buck and Mr. Nichols in a belief that there would be no more delay in the bridge-building.

The unexpected always happens. It certainly was the unexpected that a steel suspension bridge should be badly wrecked by fire. On November 10 of last year a sensational and dramatic blaze at the top of

ALL IS THEN IN READINESS TO RECEIVE THE CABLES

the Manhattan tower caused a cessation of the work and wreaked much temporary damage. In the late afternoon a careless workman overturned a rivet stove in the tool-house at the top of the tower and the dry timber false-work, well soaked with oil, made

the most beautiful and unique blaze ever witnessed hereabouts. The workmen, by means of hasty flight and, in a few instances, by the narrowest fighting chance, escaped with their lives. The fire department, when called, found that the problem of handling a fierce blaze 300 feet above their heads was beyond

PREPARED TO PLACE THE FIRST WIRE

their ability and the fire burned itself out, feeding on every vestige of woodwork about the tower-top and utterly destroying the temporary foot-path.

The bridge was thought at the time to be extensively and permanently damaged. Then it was shown that the cables, for which the greatest alarm had been felt, had

undergone at the factory a greater fire-test than was possible by the tower blaze. By means of some clever splicing of about 50 wires of one or two strands the damage was quickly and easily repaired, and another

THE FOOT-BRIDGES IN PLACE

temporary foot-bridge was rigged from the permanent cables to assist in the placing of the centre-span.

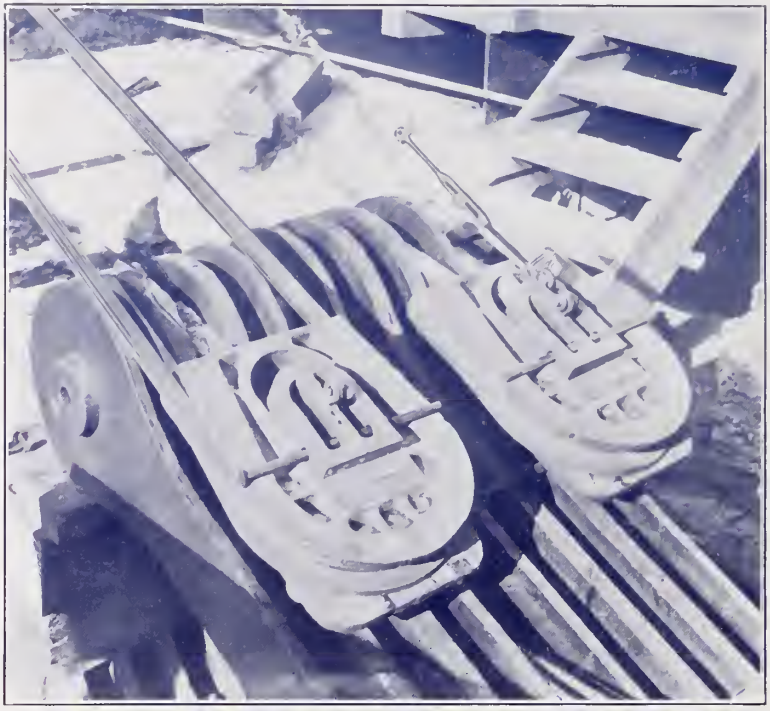
The present year has been one of great activity in the building of the Williamsburg bridge. The Pennsylvania Steel company prosecuted its contracts with great rapidity and early winter saw the bridge-builders at work upon the truss work of the centre-span. The span was built out toward the centre of the river from each tower. Great progress was made in this work, and on February 25 the steel roadways were joined and another great step in the progress of the structure was finished. Since that time the work has been in the nature of filling in missing parts and adding what may be colloquially termed finishing touches.

Chief Engineer Buck retired from his post in the past summer and became consulting engineer to the Department of Bridges, which position he continues to hold. O. F. Nichols, his assistant, retired entirely from the work. Holton D. Robinson became chief engineer and Kingsley L. Martin the resident engineer in charge of the work. They made few changes in the bridge plans, merely some substitutions in the paving of roadways and footpaths, and have faithfully carried forth the ideas of designer Buck up to the opening of the structure for daily traffic.

It is a long step from the little horse ferry which

THE "TRAVELER" THAT SPINS THE CABLES

Woodhull established from Manhattan island to Williamsburg hamlet up to the present majestic bridge. Mr. Buck has labored faithfully and produced a work of monumental character. He has reverted in the Williamsburg bridge to the earlier types of sus-



THE SHOES UPON WHICH THE STRANDS ARE FASTENED

pension bridges in which the main-span only is suspended from the cables and in which the cables from the towers to the anchorages carry no portion of the load of the structure but act simply as back-stays. His plan shortens the length of the cables and reduces the

cost of one of the most expensive features of a suspension bridge. He determined that two stiffening trusses should be used and that these should be very deep and practically continuous from anchorage to anchorage; that the two elevated railway tracks should be placed between the trusses, and that the roadways should be

FINAL TOUCHES ON THE CENTRE-SPAN

bracketed on cantilever floor-beams carried outside the trusses for this purpose. The foot-paths, bicycle-paths and four surface car tracks are all placed within the trusses.

It was decided that it is well-nigh impossible to bring many avenues of transportation through any masonry

BUILDING THE BROOKLYN APPROACH

tower of reasonable dimensions. This decision, coupled with the saving in money and time, led to the substitution of steel for stone structures, such as form so picturesque a feature of the Brooklyn bridge. The delays in the construction of these towers were, of course, not anticipated. To the bridge builders the Williamsburg structure has proved their efficacy. The next bridge, the Manhattan, will undoubtedly show still another step in the construction of steel towers. For that structure an architect has been called into consultation, and he has evolved towers of rare beauty and artistic merit.

Step by step the Williamsburg bridge has been depicted here. It is not only in great advance of the crude ferry but it is considerably better planned and

adapted for its purpose than was the still famed Brooklyn bridge. Through every detail of the work this progress and improvement is shown and a careful comparison of the Brooklyn and Williamsburg bridges will show the twenty years of progress in bridge-building. Other structures crossing the East river are bound to come, each showing the development of mechanical engineering, for there seems to be no limit placed upon the growth of this marvellous city; yet it will be many and many a long day before the Williamsburg bridge, the product of delay and anxiety and of thought and muscle, of the forests and the mines of the nation, will cease to hold the commanding position to which it attained on December 19, 1903.

THE WILLIAMSBURG TOWER SITE BEFORE THE WORK BEGAN

HOW THE BRIDGE WILL SERVE BROOKLYN

By courtesy of the Brooklyn Daily Eagle.

DEVASTATION CAUSED BY THE FIRE

Statistical Tables

Comparative Dimensions of Brooklyn and Williamsburg Bridges.

	Bridges	
Length :	Brooklyn.	Williamsburg.
Main span, c. to c. of towers.....	1,595′ 6″	1,600′ 0″
Land spans, tower—anchorage....	930′ 0″	596′ 6″
Brooklyn approach	971′ 0″	1,865′ 0″
Manhattan approach.....	1,562′ 6″	2,606′ 2″
Total of carriageway.....	5,989′ 0″	7,264′ 2″
Height :		
Clear, abv. m.h.w., at centre	135′ 0″	140′ 4¾″
Same, 200′ each side of centre....	.....	135′ 0″
Above m. h. w. to centre of cable at tower	272′ 0″	332′ 8½″
Above m. h. w. to roadway in centre of span	138′ 3″	145′ 5½″
Same, at centre of tower.....	119′ 3″	125′ 7¾″
Of tower above roadway.....	159′ 0″	210′ 0″
Width of bridge	85′ 0″	118′ 0″
Grade of roadway in 100 ft.....	3′ 3″	3′ 0″
Max. grade, roadway in 100 ft.....	3′ 9″	3′ 4½″
Foundation below m. h. w.:		
Brooklyn	45′ 0″	S.91.9′, N.107 5′
Manhattan.....	78′ 0″	S.66 0′, N 55.0′
Size of caissons : Brooklyn.....	168×102′	(2) 63×79′
Manhattan....	172×102′	(2) 60×76′
Size of anchorages :		
At base—Brooklyn	129×119′	177×158′
At base—Manhattan.....	129×119′	173′4½″×151′9″
At top.....	117×104′	149′×127′ 5″

Comparative Dimensions—Continued.

	Bridges	
	Brooklyn.	Williamsburg.
Diameter of cables	$15\frac{5}{8}''$	$18\frac{5}{8}''$
No. wires in each cable	5,296	7,700
Length of wire weighing 1 lb	12′	10′ 3″
Weight of one cable per lin. ft	500 lbs.	770 lbs.
Total miles of wire in 4 cables	14,361	17,432
Versine at mean temperature	128′	178′
Ult. strength each cable, tons	12,200	24,500
Permanent weight suspended:		
From main span cables, tons	6,780	13,740
From shore span cables, tons	7,900	0

Quantities.

The quantities of the different principal materials used in the construction of the bridge were, approximately, as follows:

Towers (each 3,048) tons	6,096
End spans, tons	6,140
Brooklyn approach, tons	6,085
New York approach, tons	10,550
Suspended span, tons	7,772
Cables and suspenders, tons	5,000
In anchorages, tons	3,100
Concrete, cubic yards	60,000
Stone masonry, cubic yards	130,000
Excavation, cubic yards	125,000
Timber, ft. B. M	8,000,000

NECROLOGY

New York Caisson

Two men killed (names unknown)

Brooklyn Anchorage

C. B. Benson, December 18, 1897
G. Erickson, June 8, 1898
Michael McCue, June 14, 1898
John Boyle, September 26, 1898
T. Moran, September 14, 1899

Manhattan Anchorage

Carmine Caravino, Mar. 8, 1898
Giuseppi Rumolo, Mar. 8, 1898
Michele Bianco, March 8, 1898
Antonio Muskite, Oct. 4, 1898
Alexander Erickson, May 11, 1900

Steel Towers and End-Spans

John Chanler, May 18, 1900
C. E. Bedell, Sept. 28, 1900
Paul Ward, November 11, 1900
Charles Miller, Feb. 26, 1901
Louis Demange, Feb. 12, 1901
Frank Aberton, March 8, 1901
E. Alexander, April 19, 1901

Brooklyn Approach

Peter A. Smith, November 19, 1901

Manhattan Approach

Joseph Winkler, July 24, 1901
Antonio Scalzo, May 8, 1902
Wm. Carroll, October 16, 1902
Carl J. Jacobson, April 9, 1903
Adolph J. Weber, July 15, 1903
Herman Hansen, July 15, 1903

Suspended Span

Patrick McDermott, September 9, 1902

Cables

Geo. Shaurer, March 24, 1902
Thomas Quinlan, April 22, 1903